ELECTRICAL WEST

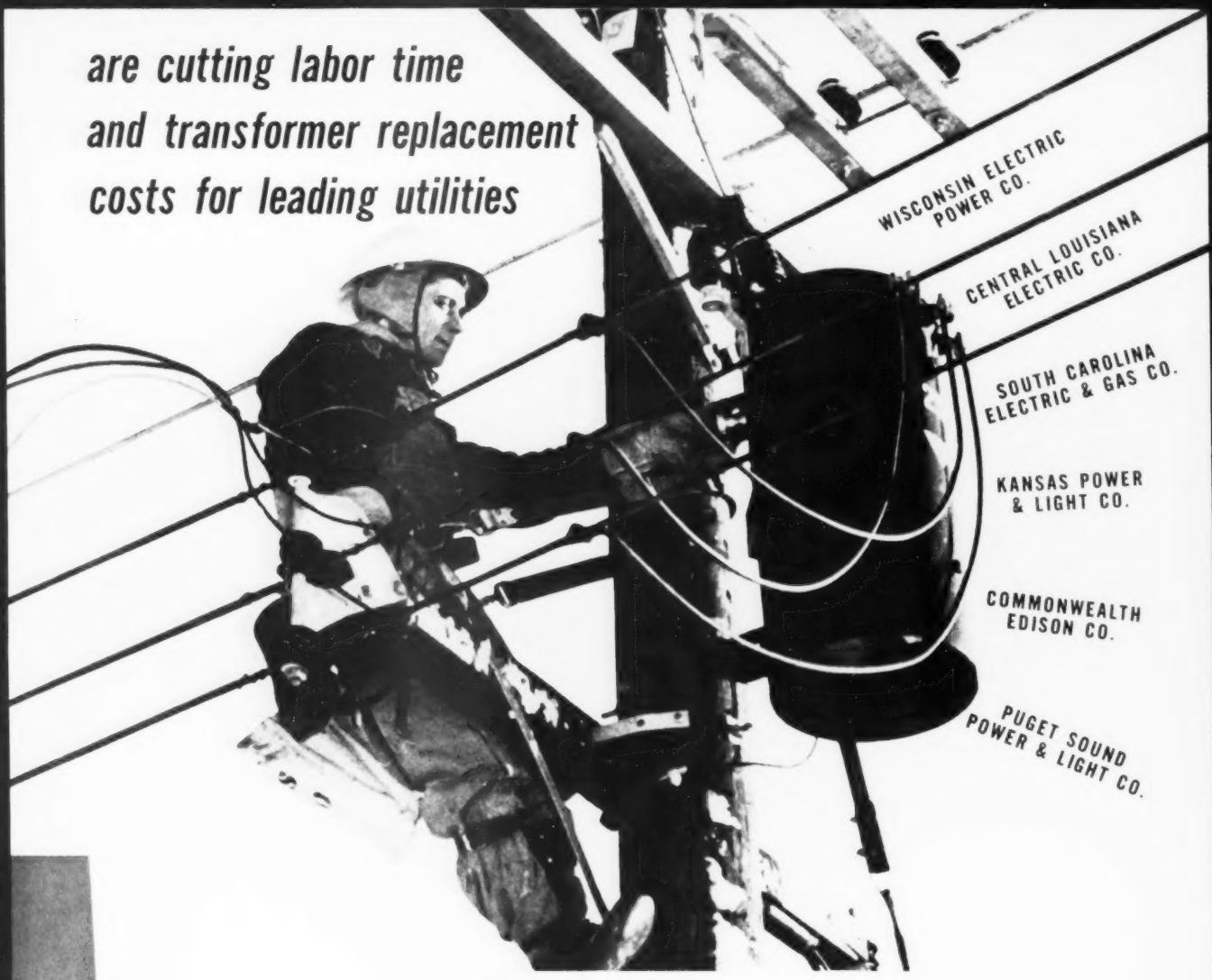
A McGRAW-HILL PUBLICATION

December 1959
50 Cents

Frozen Power

RT&E Dual Voltage Transformers

are cutting labor time and transformer replacement costs for leading utilities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CENTRAL LOUISIANA ELECTRIC CO.
SOUTH CAROLINA ELECTRIC & GAS CO.
KANSAS POWER & LIGHT CO.
COMMONWEALTH EDISON CO.
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RT & E

Introduced the *first* dual voltage transformer with external means of changing voltage.

•

Has the *most* dual voltage units in service.

•

Provides the *widest* variety of voltage combinations.

Since RT&E introduced the industry's first dual voltage transformer three years ago, an increasing number of utilities have joined the pioneer group who first installed these units.

Included among the many utilities who have installed RT&E dual voltage transformers are Commonwealth Edison Co., South Carolina Electric & Gas Co., Puget Sound Power & Light Co., Kansas Power & Light Co., Central Louisiana Electric Co. and Wisconsin Electric Power Co. RT&E has shipped over 5000 dual voltage transformers to these and other leading utilities.

RT&E is proud of the contribution it has made to the electrical industry through the introduction and promotion of the externally operated dual voltage transformer.

Available in all primary voltage combinations: 2400 x 4800 volts, 2400 x 7000 volts, 7200 x 14,400 volts, 4800 x 14,400 volts. Also custom designed to special requirements. See your RT&E representative, or address inquiries to Dept. A., Waukesha, Wis.

RT&E

ENGINEERING TALENT CONCENTRATED ON ONE IDEA — A BETTER TRANSFORMER

CORPORATION
WAUKESHA, WISCONSIN
PORTLAND, OREGON

JJ

editorial views

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Magnetohydrodynamics—Here is a new word and a new concept that offers exciting prospects for future power generation. In fact, it is so new that the editor asked one of the country's leading authorities and far-sighted power company executives to comment on the theory and possibilities of this new technique. We are pleased to be able to bring to our readers these comments from Philip Sporn, president, American Electric Power Corp.

"For more than 10 years we have been preoccupied with the development of atomic energy and exerting prodigious efforts to bring atomic fuel into the family of competitive primary energy sources. In the interim, almost unobserved, another series of most exciting developments has been coming along that may open up a new era in the generation of electric energy.

"There are three such developments – each dependent upon a different principle: thermionic generation, thermoelectric generation and generation **by the application of the magnetohydrodynamic principle.** What ties them together is that each promises direct conversion of heat energy into electric energy.

"Of these, magnetohydrodynamic generation is the most intriguing. The concept of magnetohydrodynamics is simple enough. Faraday's discovery of electromagnetic induction brought to light the fundamental law that, when a conductor and magnetic field are moved one with respect to another, an electric voltage is induced in the conductor and when a load in the form of a motor, lamp or appliance is connected to the terminals of the conductor an electric current flows through it.

"Faraday's law of conduction does not tie down the conductor to any special form—a loop of copper wire, for example—the conductor could be a fluid, an ionized gas or a liquid. The motion of such a fluid with respect to a magnetic field constitutes the phenomenon of magnetohydrodynamics.

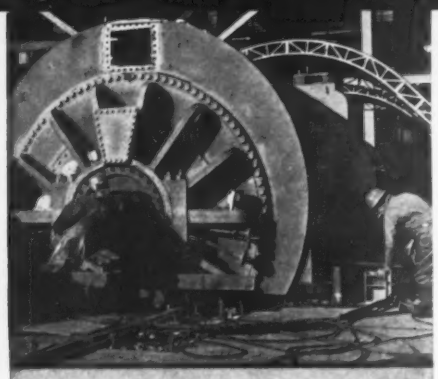
"The recent announcement of General Electric Co. that they had developed about 1 kw of electric energy for a period of five seconds at their Aerosciences Laboratory in Philadelphia gives point to this exciting principle. Even more intriguing is the announcement that a group of 10 eastern utilities working with Avco had agreed to carry forward work cooperatively at the Avco-Everett Research Laboratory, where a generator operating on the magnetohydrodynamic principle had recently attained an output of 10 kw.

"All this has opened up new vistas of technological growth and development that cannot help but be enormously stimulating to everyone interested in the future of the electric industry."

ELECTRICAL WEST is particularly happy to congratulate Avco and the group of 10 utilities associated with it in their carrying this work forward without the intervention of any governmental agency and without any subsidies from the government.

Tie-lines to the Future—Five progressive, investor-owned utilities in the Intermountain area have banded together and blueprinted the coordinated transmission network it will take to serve their combined areas during the next twenty years. Their findings are reported on page 59. This forward step in intercompany cooperation and coordination is to be commended if for no other reason than it provides public reassurance that these public service organizations have not only recognized their obligations for the future but have taken steps to insure that they will be carried out.

ELECTRICAL WEST has suggested that regional planning of this character might well be extended on an interregional basis to embrace the entire area from the Rockies to the Pacific Ocean. Perhaps the time is not ripe for such broad-scale planning, but the day is not far off when this kind of horizontal cooperation may be a necessity.



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ELECTRICAL WEST

SPOKESMAN FOR THE MOST HIGHLY ELECTRIFIED REGION OF THE U.S. Established 1887

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The Cover—Chapel of the Transfiguration at Moose, Wyo., in the Grand Teton National Park. Photo by George Waters.

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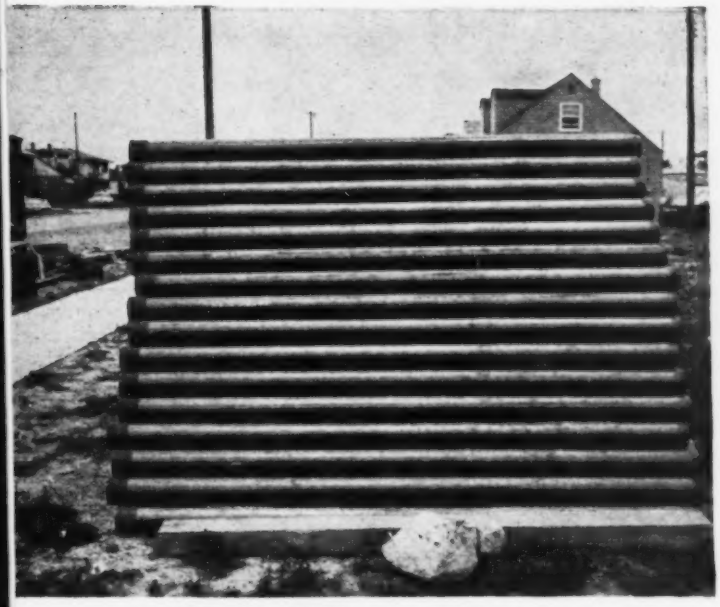
Flush-Fit Couplings on L-M Permaline Conduit Provide Big 3-Way Savings



SAVINGS IN STORAGE are realized since the coupling is attached to the conduit. Coupling cartons are eliminated.

Big savings are possible with L-M Permaline Conduit and the Flush-Fit Coupling. The couplings are installed at the factory on one end of each 2, 3, 3½, 4, 4½ and 5-inch sizes of Permaline Conduit. Thus, you save in three important ways since the coupling and conduit are bought, stored and installed as one complete unit:

Savings in Storage . . . coupling cartons are eliminated.

Savings in Handling . . . coupling and conduit are one unit.

Savings in Installation . . . coupling is already attached; no couplings to attach on the job site.

L-M Flush-Fit Couplings have the same outside diameter as the conduit. Joints do not have to be staggered. You install Permaline conduit as fast as you can get it into the trench.

Other Permaline Advantages

Permaline Conduit offers many other time and money-saving advantages:

Smoother Inner Bore . . . Faster, trouble-free cable pulling.

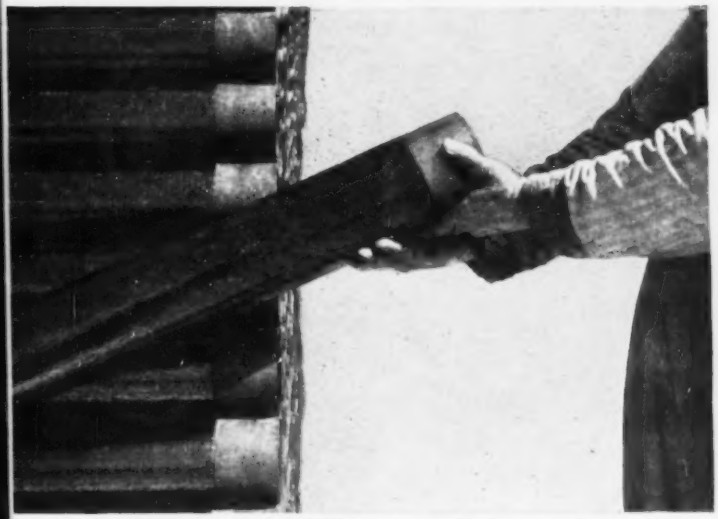
Choice of Shipping Methods . . . Bulk, fork-lift bundles or steel-strapped slings for fast, easy handling.

Complete Line . . . All sizes; 5, 8 or 10-foot lengths; all accessories.

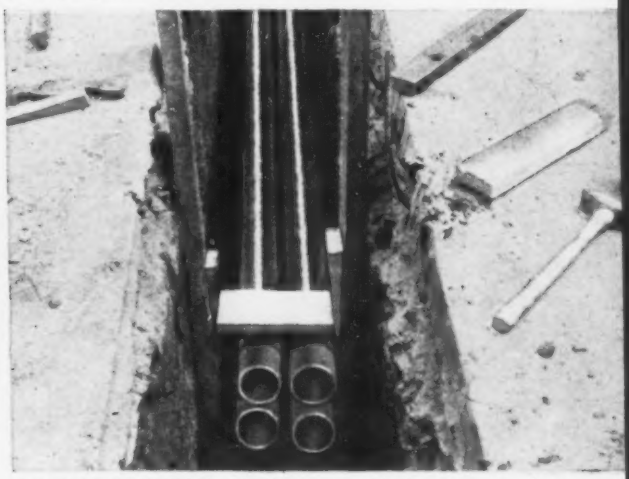
Complete Stocks At Strategic Warehouses . . . One is conveniently located near you.

Exceptional Service . . . More than 100 Permaline representatives in the U. S. ready to serve you.

Engineering Service . . . Complete technical assistance on your proposed system.



SAVINGS IN HANDLING are possible because the coupling is attached to the conduit at the factory. No cartons to check in and out of your warehouse.



SAVINGS IN INSTALLATION are possible because coupling and pipe are taper-fitted, and need only be driven with wood block and hammer to provide tightest possible joint.

Get Complete Information . . . For complete information on Permaline Conduit with Flush-Fit Couplings or any Permaline product, contact your L-M Field Engineer or Permaline Specialist; or, write Line Material Industries, Milwaukee 1, Wisconsin; ask for a copy of L-M's Underground Construction Handbook, 12-point Plan Folder and Permaline Conduit Bulletin UG1A. In Canada: Canadian Line Materials, Division of McGraw-Edison Company (Canada), Limited, Toronto 13, Ont.

LM

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427

Permaline Fibre Conduit

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

What's new in plant expansion?

Steadily rising costs are causing many electric utilities to take a searching look at traditional methods of handling plant expansion.

An increasing number of companies are finding that the total-responsibility contract, which has long been standard practice in the petroleum and chemical industries, offers important advantages to a utility.

When a single integrated firm is given full responsibility for design, engineering and construction and undertakes to deliver a plant that meets definite performance guarantees, then the contractor is also in a position to guarantee completion date and total cost—*and should be willing to do so.* With these two factors firmed up, financing problems are eased considerably. Risks are minimized, as the contractor assumes most of them. Lead time is shortened and continuity of the job is assured. The utility's own engineers, freed from a multitude of detailed responsibilities, can function on their proper level of operations management, broad supervision and long-range planning.

Furthermore, the integrated contractor, in control of all phases of the job and making a single profit, has a considerable advantage over a series of independent contractors handling separate phases. Through efficient management, procurement and scheduling he should be able to deliver more total plant value per dollar of investment.

It is Fluor's belief that the total-responsibility contract, with price and completion guarantees, is the best answer in many electric-utility situations, and Fluor is one of a very few engineering-construction firms serving the industry which encourage this type of contract. For detailed information on how the system works, write to Utility Sales Department, The Fluor Corporation, Ltd., 2500 South Atlantic Boulevard, Los Angeles 22, California.

HOISTING THE DRUM—dramatic moment in the construction of every steam station. This one is being installed by Fluor at Cameo, Colorado, where Public Service Company of Colorado is adding a 44-mw. unit to its existing plant.

When you consider expansion . . .
the most important investment
you can make is in the
creative ability of men.

FLUOR

Engineers and Constructors

EW news roundup

EXPERT?—Senator Frank E. Moss (D-Utah), after being in Russia for a month with Senators Edmund S. Muskie (D-Maine) and Ernest Gruening (D-Alaska) returned home making big noises about the rapid growth of Russian hydroelectric development. Apparently acting as a self-appointed expert, he managed to get across the idea that they will be producing more hydroelectric power than the U. S. in the next 10 years. He then used this as a tub to thump for more hydroelectric development in the Pacific Northwest.

Apparently he learned more about Russia than he knows about the United States because he said, "Although the region (the Pacific Northwest) contains 40% of the potential hydroelectric power resources in the United States, there has not been a single new project started since 1952."

A Salt Lake *Tribune* reader, Howard O. Wiscombe of Bountiful, Utah, in a letter to the editor, delightedly rubbed the senator's nose in the fact that since 1952 there have been started: The Dalles, 1954; Priest Rapids, 1956; Brownlee, 1958; Oxbow, 1958; John Day, 1959; Swift, 1957; Wishon, 1954; Ice Harbor, 1957; Rocky Reach, 1957; Cochrane, 1955; Donnells, 1954; and Box Canyon, 1953. And there are others too.

Commented Wiscombe, "The taxpayers should demand that the senator tour our own facilities before he goes on our expense account as a traveling expert."

—EW—

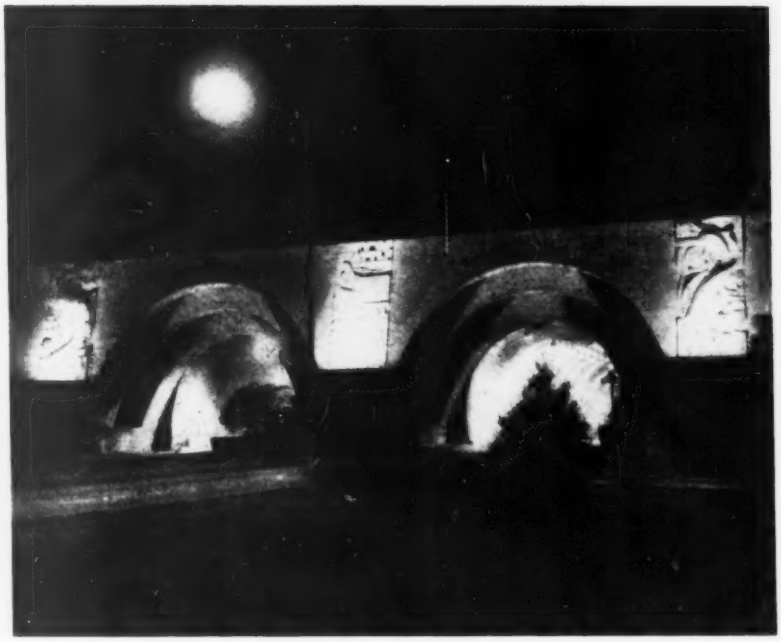
INSTITUTION—Dr. Chauncey Starr, vice-president of North American Aviation and general manager of the company's Atomics International Division, says:

"A sound, economic, commercial, profit-motivated and profit-rewarding (atomic power) business will be created by the efforts of those who look upon this industry as a business rather than as an institution.

"The nationalization of this major technology at the cost of throttling the embryonic atomic industry is a trend of economic philosophy which is a complete antithesis of the strongest motivations our country has ever had for major accomplishment; namely, the profit incentive."

—EW—

Bill Rogers, manager of press relations for General Electric's Lamp Division, sent Electrical West *one of the heliochronometer sundials that has proved to be such a popular promotion piece. He says there are a limited number available still. Your request for one should carry your name, address and 25c to cover handling and transportation costs. It should be addressed to General Electric Co., Dept. PR11X, Nela Park, Cleveland 12, Ohio. They are fun to play with.*



After 18 years of darkness, lights shine again on these bas-relief designs at the eastern end of the Lake Washington bridge tunnel in Seattle. The lights were turned off during World War II blackout regulations and no one remembered to turn them on again after

NO PIRACY—Stealing engineers from each other is not quite as popular a sport among manufacturers as many people believe.

McGraw-Hill's *Product Engineering* conducted a survey that shows that engineers changing jobs next year will be less than one in ten. The one that changes will probably be for a better working atmosphere or more challenging assignment rather than a phenomenal increase in salary or pie-in-the-sky promises.

The survey shows that today's engineer is a rather substantial fellow who is looking for opportunity, growth potential, perhaps a private office and a title. Once he finds a place that offers him about what he is after, he settles down, becomes active in his community, and is not anxious to move.

A survey of 387 companies by the Engineers Joint Council shows that

Balance . . .

what does it mean in cable?

No one characteristic alone determines good cable. It's the right balance of many qualities that counts. Carol *has* this balance. Look at these significant test results.

	BRAND			
	CAROL	A	B	C
Electrical Insulation Resistance (1)	100	17	16	68
Cold Bend °F (2)	−50	−45	−90	−50
Abrasion Resistance (1)	91	62	100	92
Ozone Resistance (1)	100	6	18	12

Note: (1) 100 indicates best—others % of best (2) cold bend—actual test temperature

As can be seen, needlessly high cold flexibility can be built into cable . . . but only at the sacrifice of more important electrical properties. And in Brands A, B and C you will also note the lack of balance between abrasion resistance and ozone resistance . . . which means these cables can crack long before they wear out.

Carol, on the other hand, has not only the highest *combined* rating but is also the best *balanced*. As a result of years of experience and research, primary emphasis has been placed on the characteristics most vital in cable life and performance.

To you, this means superior quality *throughout* . . . *extra* quality and performance where it is most needed.

when you call for cable— call for

Carol®

PORTABLE CORDS • POWER SUPPLY CABLE • CONTROL CABLES • WELDING CABLE • GOVERNMENT TYPES • CORD SETS

For phone number of closest representative see advertising index in back of book.

LABORATORY CONTROLLED...

Crapo

GALVANIZED STEEL STRAND FOR GUY, MESSENGER and OVERHEAD GROUND WIRE

The high, uniform, consistently dependable quality of Crapo Galvanized Steel Strand is the direct result of close laboratory control over each step in manufacture. All wires used in forming a particular size and grade are produced from steel of selected analysis, carefully processed under technical supervision and stranded on precision machines. Both wire and finished strand are subjected to prescribed laboratory tests to insure the desired end result.

Heavy, uniform, tightly-bonded zinc coatings, applied by the famous Crapo Galvanizing Process, provide maximum resistance to corrosion.

Write for booklet OG-25 containing "Sag and Tension Data for Overhead Ground Wire."

INDIANA

STEEL & WIRE CO., INC., Muncie, Indiana

A new source of electrical power—fuel cells—has come out of the laboratory to power a vehicle. The electricity that drives this experimental tractor developed by Allis-Chalmers comes from 1,008 individual fuel cells. These are joined in 112 units of nine cells each. The 112 units are arranged in four banks and electricity can be taken from any combination of the banks. A mixture of gases—mostly propane—fuels the cells. The gases are fed into the cells through a system of tubing and, once in the cells, the gases react in an electrolyte. A catalyst coating the electrodes of each cell aids the reaction. The research tractor develops at least 3,000 lb of drawbar pull

turnover in industry in 1957 for all reasons was 11%; last year it was approximately 9%.

—EW—

Pacific Gas and Electric Co. conducted a survey that shows that one out of three of its customers does not know that its rates are regulated. This is probably about par for the course across the nation.

—EW—

GUESSING GAMES—General Electric Co., through its heating control distributors, has announced a nationwide contest for dealers. All contestants have to do is forecast the snowfall at Stampede Pass, Wash., and the temperature at Mt. Washington, N. H.

First prize is a trip for two to Florida (which Californians would consider no better than a booby prize) and there are five additional national cash prizes besides barometers for nearly everyone. Entry blanks are available from authorized General Electric heating control service centers.

CORROSION COURSE—The fifth annual corrosion control short course, sponsored by the Houston Section of the National Assn. of Corrosion Engineers, will be held Jan. 22 and 23, 1960, at the University of Houston. The course is intended for municipal, industrial, utility, transmission, and distribution engineers involved with corrosion problems and will cover the fundamentals of corrosion, cathodic protection and the maintenance and operation of corrosion preventive systems. Information can be obtained by writing M. A. Riordan, Rio Engineering Co., P. O. Box 6036, Houston 6, Texas.

—EW—

WAR CLOUDS—At about the time you are reading this, intervenors in the application of Pacific Northwest Power Co. for a High Mountain Sheep Dam will have filed their objections with the Federal Power Commission.

Hearings on the application will probably start in January, and once again Pacific Northwest Power Co. will be battling for the right to develop the Middle Snake River.

Washington, D. C., observers say that one of the bitterest fights yet on record for a hydroelectric license application is in the offing. In addition to renewed opposition from public and federal power advocates, the Mountain Sheep case could easily result in an unusual intragovernment fight between the Interior Department and the U. S. Corps of Engineers.

Portland General Electric, Washington Water Power, Montana Power and Pacific Power & Light companies will need the moral support of the whole investor-owned electric utility industry.

—EW—

A major manufacturing company reports that in 1953 a certain pump cost $244.96 to make in its American plant and $148.96 in its foreign plant. In 1958, it cost $348.55 to make the same pump in the American plant because of inflation and wage increases, while the cost to make it in the foreign plant had actually declined to $140.57.

—EW—

CENSORSHIP – Do you know that a kind of left-handed censorship of your advertising may come out of an Internal Revenue Service proposal to prevent companies from deducting as business expense money spent for such purposes as informing customers about legislative issues?

Particularly vulnerable are those businesses dominated by large and aggressive labor unions and close government regulation whose interest in legislative affairs is direct and vital.

The electrical industry fits these qualifications.

—EW—

Prices of large steam-turbine generators, 60,000 kw and up, are down about 5%. Clyde Lilly, manager of marketing for General Electric's large steam turbine generator department, forecasts a long term trend toward lower prices. He also points out that this latest cut is not the result of lower costs, however. L. M. Eikner, manager of the large and medium steam turbine generator department for Westinghouse, said essentially the same thing.

Armoring
is a
"Snap"
with...
FANNER
Superformed* RODS
Any hands are expert
No special skill is needed to expertly apply Superformed Products. When the last rod snaps into place you are assured of permanent, full-length gripping protection against mechanical and electrical damage.
The unexcelled Superforming process of making helical reinforcements is another development of Fanner's long years of specialized wire-forming experience. Write for catalog showing complete lines.
FIRST IN THE FIELD...AND CONTINUOUSLY IMPROVING ITS PRODUCTS THROUGH INDEPENDENT RESEARCH AND DEVELOPMENT
ARMOR RODS FANNSPLICES FANNGRIPS
LINEGUARDS PATCH RODS TAP ARMOR
PLASTIC FANNGUARDS KOVERGARD MOLDINGS
Fine FANNER
Superformed Products
THE FANNER MANUFACTURING CO.
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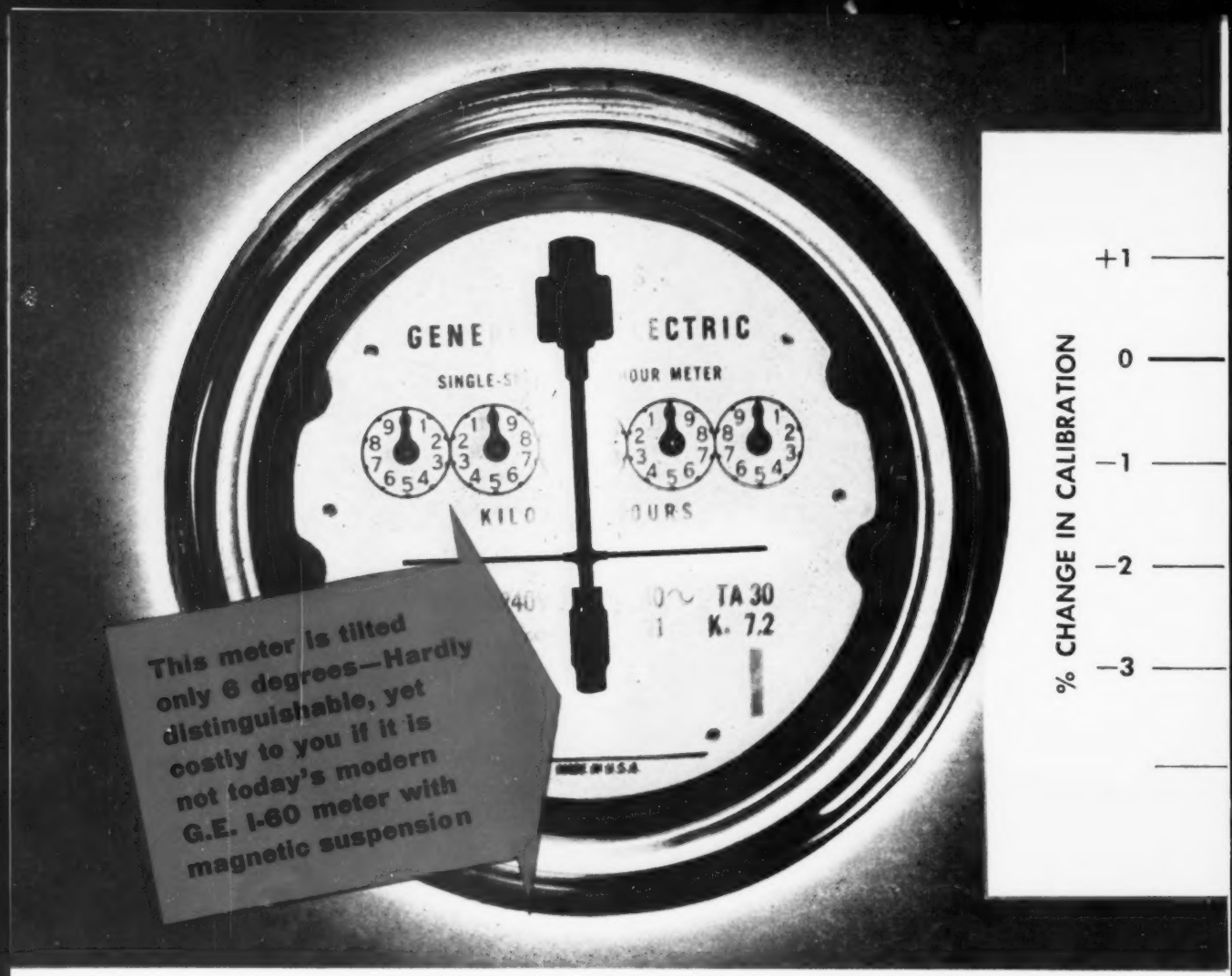
For phone number of closest representative see advertising index in back of book.



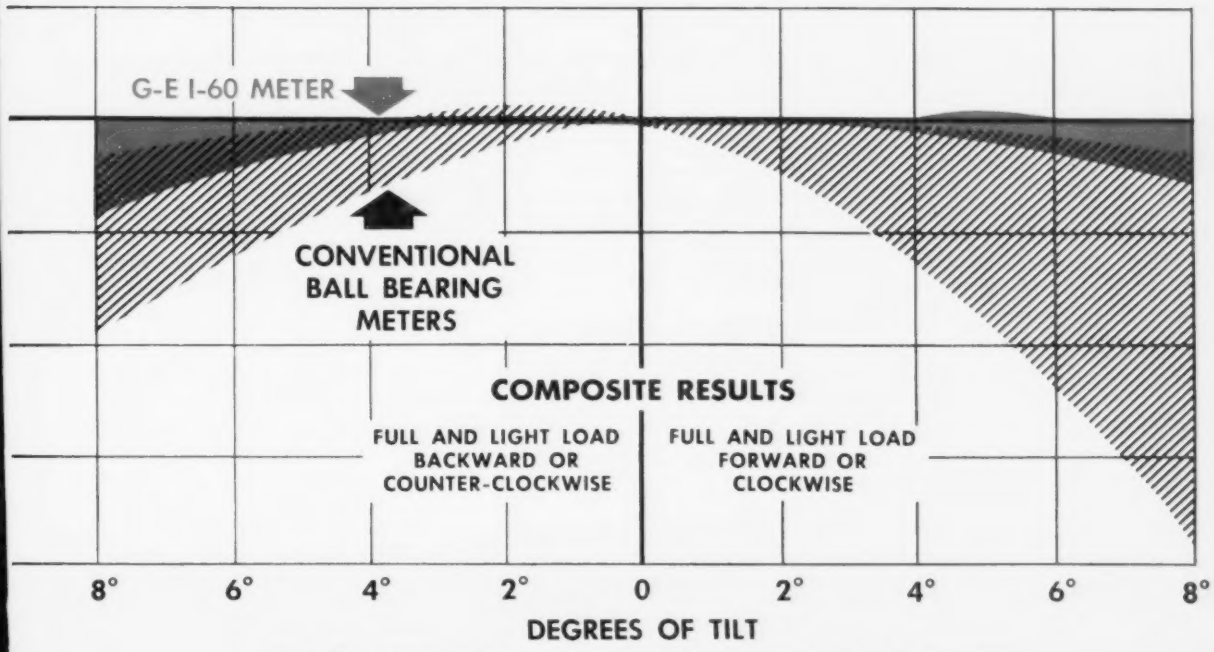
No need for lost revenue from tilted meters

Untold numbers of watthour meters in service today are operating at a tilt from true vertical. This condition may be due to improper mounting, to accident, molesting of the installation, or uneven settling of the house, pole, or building on which the meter is installed.

Regardless of how "tilt" occurs, however, the fact is that, with old-style, ball-bearing assemblies, *tilted meters run slow, thereby causing revenue losses.* Actually, a single ball-bearing meter—tilted *just six degrees* from vertical—can cost a utility as much as $50.00 in 30 years of operation. Multiply this figure by the number of meters *you* have in service . . . then read the next page for a solution to this problem, which is costing you and other electric utilities hundreds of thousands of dollars in lost revenue every year.

AVERAGE TILT ERROR

3W, 240V, 30-amp, Class 200 Single-stator Meter



NOTE: *The gray area contains the average results of three manufacturers' conventional class 200 ball-bearing meters. The red area contains the average results of General Electric's Class 200 I-60 meters with magnetic suspension.*

...When it's so easy to overcome the problem

Because the disk and shaft in General Electric watthour meters are suspended *magnetically*, G-E meters (single-*and* polyphase) are virtually unaffected by tilt-caused error —error which *slows down* ordinary ball-and-jewel meters. (The relative spans of calibration change on the above chart show that ball-bearing meters average as much as 2 to 3½% slow at only 8° of "Tilt".) Unique, "free-floating" G-E magnetic suspension can substantially reduce that loss figure you calculated on the opposite page.

For more information, contact your G-E apparatus salesman. Or, write for Bulletin GEA-6683, General Electric Company, Schenectady 5, N. Y.

628-31

GENERAL ELECTRIC

Generation after generation . . .

In all parts of the country, Shell Turbo® Oil has enabled operators to get maximum service life from central station equipment because of these features:

1. It has exceptional oxidation stability for maximum service life.
2. It separates readily from water.
3. It protects against rust.
4. Its formulation does not vary—make-up oil is identical to the original charge regardless of time of purchase.

A Shell Industrial Products Representative is available to discuss technical data on Turbo Oil with you. *Call or write today.*

SHELL OIL COMPANY

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SHELL

PRODUCT NEWS

New Designs and Applications

New Distribution System

(1) *BullDog Electric Products Division, I-T-E Circuit Breaker Co., Box 177, Detroit 32, Mich.*

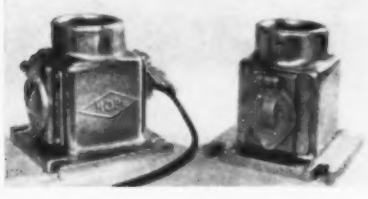
A new system for distributing electricity in industrial plants and commercial buildings has been developed by this company. Features are flexibility, easy installation and plug-in power take-offs at any point without disconnecting the main power line.

It will be available after the first of the year in ampere ratings of 225 through 1,000 and voltage ratings through 600 v a-c with full neutral available in all sizes.

Separate plug-in switches may be attached at almost any point and moved at any time with the power still on. It will come in 10-ft lengths and will have elbow units and short end-pieces for turning corners and adapting to available space.

The duct casing is said to meet present building structural standards which reduces installation costs. Sections are joined with four screws and one bolt.

When installing a bus plug, the plug-in cover must be closed until the switch plug is in a safe position and it cannot be attached or removed while the switch is in "on" position. The company says it is almost impossible for an electrician to touch a live bus bar.



Pole Base

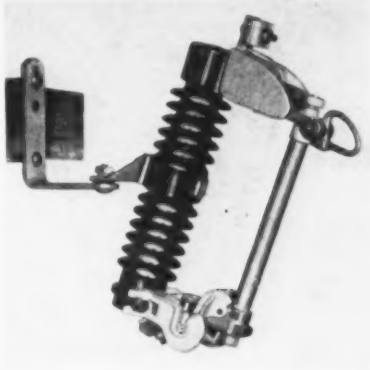
(2) *Hope Electrical Products Co., 39 Long Ave., Hillside, N. J.*

This new pole base has its own junction chamber accessible through the front cover. It features an optional 208-v weatherproof three-pole receptacle cover, in addition to the previously available optional 110-v, three-pole cover. The new model was developed as a result of increasing installation of 110/208-v lines. Also emergency generator units for lighting and high-speed power tools demand a greater supply of high-voltage auxiliary power in out-of-doors maintenance operations. The base is available in sizes to receive 2-, 2½-, 3- and 4-in. threaded pipe.

Mechanical Dead-Ends

(3) *Fargo Mfg. Co. Inc., 845 Main St., Poughkeepsie, N. Y.*

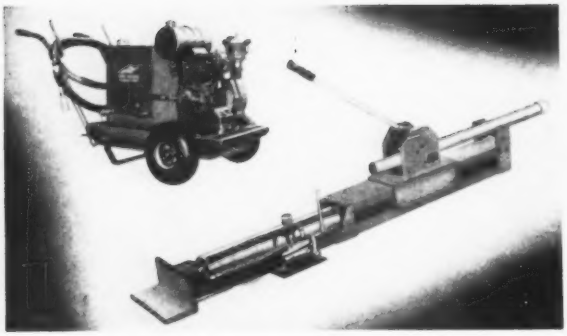
This new mechanical dead-end has what is termed a "double dip" clamping action with a straight line pulling eye. Special features include drainage points, a smooth curved mouth for cable protection and an eye on the one piece keeper assembly for hot stick application. Available in either aluminum or malleable iron.



Open Cutouts

(4) *Line Material Industries, McGraw-Edison Co., 700 W. Michigan, Milwaukee 1, Wis.*

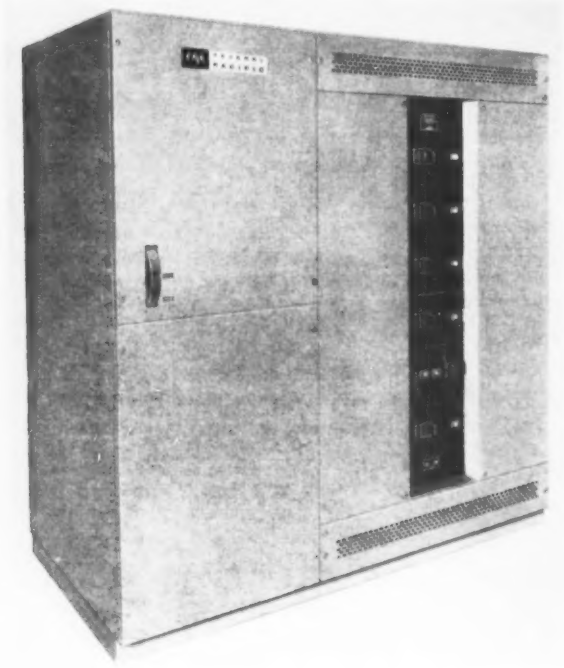
This new line of 100-amp open cutouts extends overcurrent protection to a range previously unattainable, according to the manufacturer. They have voltage ratings of 7.8, 15 and 27 kv and feature interrupting ratings of 20,000, 16,000 and 6,000 amp. It has interchangeable fuseholders that accept any EEI-NEMA standard button-type fuse link.



Pipe Pushers

(5) *Mercury Hydraulics Inc.*, 1632-46 *Wazee St., Denver 2, Colo.*

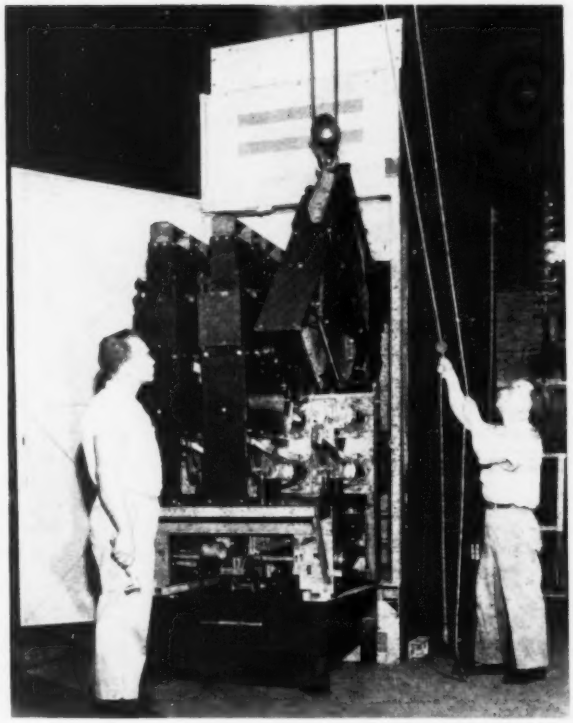
New pipe pushers offered by this company come in three sizes capable of gripping up to 4 in. inside diameter pipe and develop thrusts up to 110,000 lb. They are capable of pushing pipe at the rate of one foot in 11 seconds with only a 12-in. stroke.



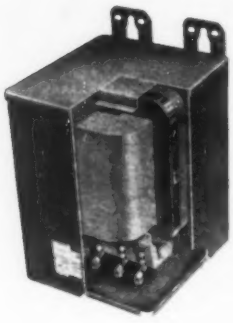
Package Power Centers

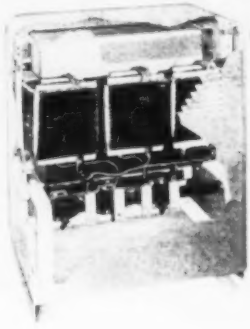
(6) *Federal Pacific Electric Co., 50 Paris St., Newark 1, N. J.*

This new line of indoor unit substations is rated up to 500 kva. They are designed to transform and control power at primary voltages of 5 or 15 kv to secondary distribution voltages at the point of use. Each unit has primary switch, transformer and secondary distribution sections. Maximum over-all dimensions are 78 in. high, 98 in. long and 42 in. deep. Various capacities are available for the three sections.



This is the first of powerful new 1,000-mva interrupting capacity units in a 13.8-kv line of air magnetic circuit breakers being produced by I-T-E Circuit Breaker Co. Features include (1) stored-energy closing mechanism, (2) high efficiency arc chute and (3) a compact design. The company says new techniques allow one-third higher interrupting capacity without increasing size over a 750-mva unit. Breaker arc chute is being tilted for inspection





400-Cycle Transformers

(7) *Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.*

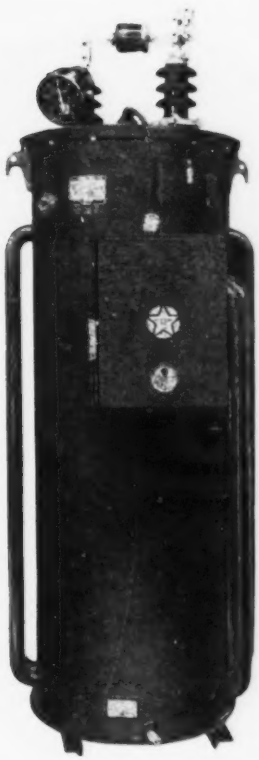
A complete line of 400-cycle dry-type transformers from 500 kva, 600 v and below, single and three phase, is now available from this company. They are designed for use with ground power supplies, portable test equipment or any type of 400-cycle distribution system. The transformers can be mounted in any position. Pictured are two different types: EP at the left and DT-3 at the right.

Use Coupon for More Information . . . p 22

Not just a few "Introductory" Sizes...

Pennsylvania Pole Star Regulators

are available in all standard distribution ratings



POLE STAR Regulator for Platform or Pad Mounting

POLE STAR Regulator for Pole Mounting

27 single-phase distribution ratings for pole, platform, and station installations

Although new in itself, the single-phase Pole Star Regulator is a product of Pennsylvania Transformer's highly successful long-term experience in two related fields: distribution transformers and power-transformer load tap changers. As a result, Pennsylvania has introduced the Pole Star Regulator not in just a few initial ratings, but in a complete range of distribution sizes—a total of 27 different ratings for pole-top, platform and station installations.

2 service-proved tap changers for regulation in 32 steps of 5/8%

The new Pole Star Regulator combines Pennsylvania's patented Pole Star Distribution Transformer with two service-proved LTC mechanisms: a spring-drive LTC for current ratings 200 amperes and below, and a direct-drive LTC for higher current ratings. Each was chosen for its ability to deliver long-range economy and efficiency in its applicable ratings. Regulation is in 32 steps of 5/8% each.

"Mor-Amp" and other controls give maximum flexibility

An easy-to-use "Mor-Amp" feature permits regulating capacity to be increased to as much as 160% of rated current at reduced range. In addition, voltage level can be varied from 110 to 140 volts . . . time delay from 10 to 120 seconds . . . operating band from 3/4 to 6 volts . . . and both reactance compensation and resistance compensation from 0 to 24 volts. Such flexibility permits adjustments to meet widely varying local conditions.

Want more facts . . . or a demonstration?

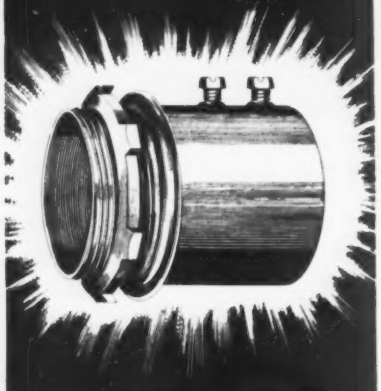
In the few months since it was introduced, the Pole Star Regulator has met with enthusiastic acceptance among many of the nation's leading utilities. If you are not yet familiar with this outstanding addition to the Pennsylvania line, write, wire or phone today for the complete facts, or to arrange a demonstration for your engineering and purchasing personnel. Distribution Sales, Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pa.

VOLTAGE	KVA	Rated Capacity (Amps)	"Mor Amp" Capacity (Amps)
2500	25	100	160
	37.5	150	240
	50	200	320
	75	300	480
	100	400	640
	125	500	668
	167	668	668
5000	25	50	80
	50	100	160
	75	150	240
	100	200	320
	125	250	400
	167	334	534
7620	11.4	15	24
	19.1	25	40
	38.1	50	80
	57.2	75	120
	76.2	100	160
	114.3	150	240
	167	219	350
	250	328	524
13800	34.5	25	40
	69	50	80
	138	100	160
14400	36	25	40
	72	50	80
	144	100	160

Pennsylvania Distribution Regulators

For phone number of closest representative see advertising index in back of book.

NOW...all UL ETP fittings are Chromate Plated FOR LASTING PERMANENCE!



...AT NO INCREASE IN PRICE!

Concrete tight! Every size connector and coupling up to 2". Why settle for ordinary fittings when ETP gives you all this:

- New sparkling Zinc Chromate overplating for lasting permanence. Salt spray tested to retard corrosion.
- Exclusive pre-set, deep-slotted STAKED screws. No backing out for conduit.
- Concrete tight with heaviest gauge wall thickness. U.L. file card E24788.
- Precision bevelled edges with extra heavy duty locknut.
- One piece solid tubular steel—cannot open or spread. Sized for uniformity.
- Available in ½", ¾", 1", 1¼" (one screw type) and 1½" and 2" (two screw type)

CONNECT WITH ETP FOR ECONOMY

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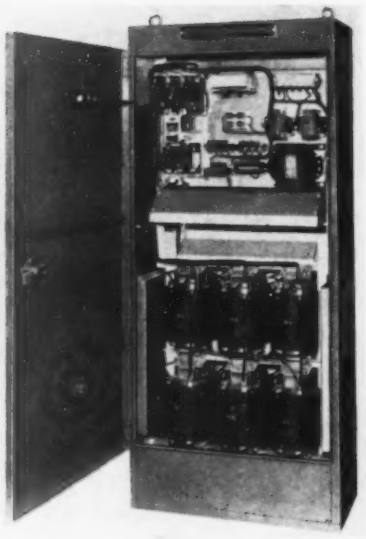
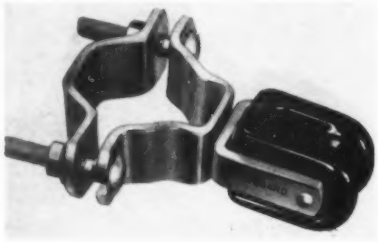


Adjustable Voltage Drive

(8) *Square D. Co., 4335 Valley Blvd., Los Angeles 32, Calif.*

Using static power magnetic amplifiers, this company has developed a new adjustable voltage drive that provides high reliability and quiet operation. It is designed for applications where warm-up time or vibration cannot be permitted. It is said to save up to 51% floor space and is 43% lighter than equivalent motor-generator-type drives. Available in standard packages in sizes ranging from ½ hp to 200 hp. Standard modifications include dynamic braking, reversing, jogging and dynamic slowdown.



Wireholder

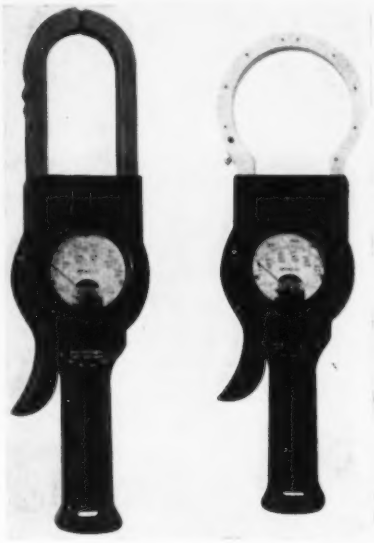
(9) *Hubbard & Co., 200 S. Michigan Ave., Chicago 4, Ill.*

This new wireholder is for use on service entrance masts from 1¼- to 2½-in. nominal pipe size. Bolts do not have to be removed when attaching the bracket to the pipe. By loosening the nuts, the head of one bolt may be slipped through a slotted open end. The keeper strap also has a slotted hole to allow play for this movement. When using 2- and 2½-in. pipe, the bracket is used as illustrated. For smaller pipes, the keeper strap is inverted.

Solvent Sprayer

(10) *Binks Mfg. Co., 3114 Carroll Ave., Chicago 12, Ill.*

Development of a spraying outfit for the application of Freon solvent is announced by this company. The solvent is used for cleaning electric motors and other electrical apparatus in place. The spraying unit consists of a pump, flow gun, fluid nozzle and hose with appropriate connections. Pump speed is controlled by an air adjustment valve.



Clamp Ammeters

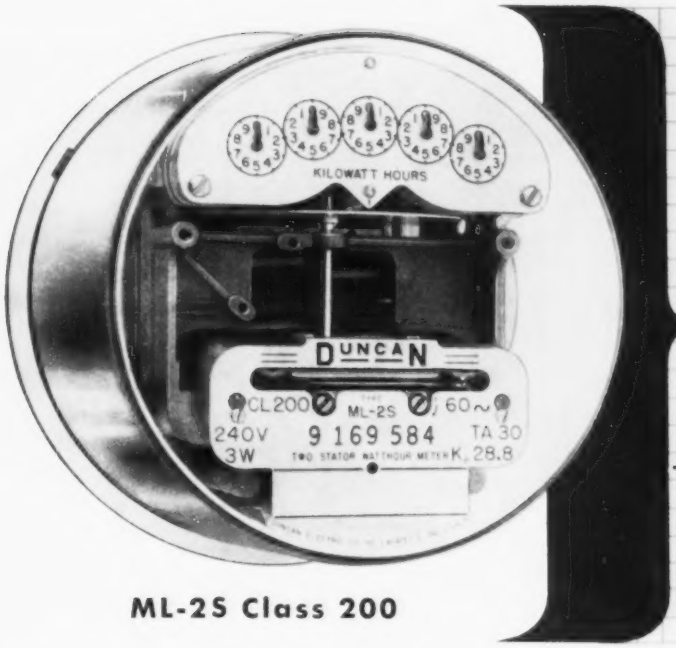
(11) *Western Electro-Mechanical Co. Inc., 300 Broadway, Oakland 7, Calif.*

These new instruments consist of the Weston model 633 with expanded clamping jaws that allow the ammeter to be used on much larger conductors than was previously possible. Current values most frequently encountered in industrial and service work are completely covered by the three or six ranges, depending on the type instrument selected. Four models are available.

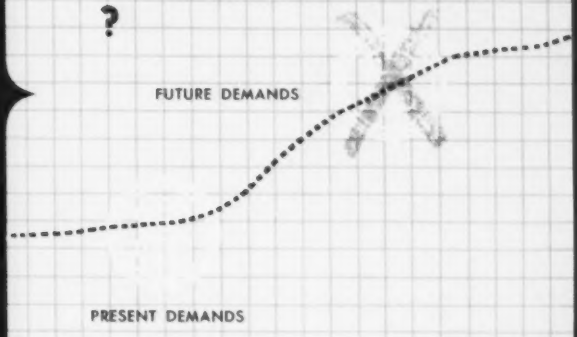
FOR MORE INFORMATION FROM MANUFACTURER
Fill in Coupon on p. 22

why pay twice

TO COVER FUTURE DEMANDS ?



ML-2S Class 200



DUNCAN

200 AMP
extended range polyphase meter

- **Accurately meters loads up to 200 amperes**
- **Reduces cost of replacement to meet increased demand**
- **Gives you more metering capacity per dollar**

DUNCAN Extended Range Meters can substantially reduce your metering costs. For example, the DUNCAN ML Class 200 Socket Type Polyphase meters accurately measure loads from a few watts to the meter's full 200 ampere capacity. Thus, it stays on the job long after increased demand has made it necessary to replace meters of lower capacity. You save both on installation time and on the cost of new meters . . . you get more metering capacity and longer metering service per dollar spent.

When you install DUNCAN meters you are assured of the finest performance that over 50 years of specialized meter experience can provide. One significant example is the long range load curve shown below.

"Thinking Ahead . . . Moving Ahead . . . to stay Ahead of Demand!"

DUNCAN "COMPANIONS"

save space • save time • save money

EXTENDED RANGE POLYPHASE METERS

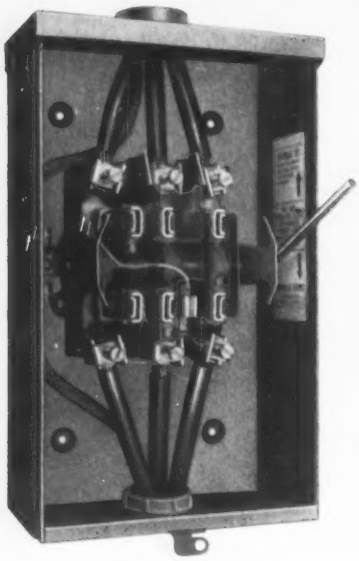
DUNCAN
ML-25 Class 200
3-Phase 3-Wire

ML - 2½S

3-Phase 4-Wire Wye

ML - 2S△

3-Phase 4-Wire Delta



DUNCAN HQ | High Capacity-Quick Operating MOUNTING DEVICE

. . . featuring simultaneous by-passing and releasing of meter clamps

DUNCAN Type HQ mounting device (singlephase or polyphase) is conservatively rated for high load factor loads up to 200 amperes using self-contained socket type meters having a maximum capacity equal to the load to be served. DUNCAN HQ has many important construction and "use" features which add substantially to convenience and economy of installation.

← TYPE HQ-7

Used with 7-terminal meter on 3-phase 4-wire wye or delta services

TYPE HQ-5

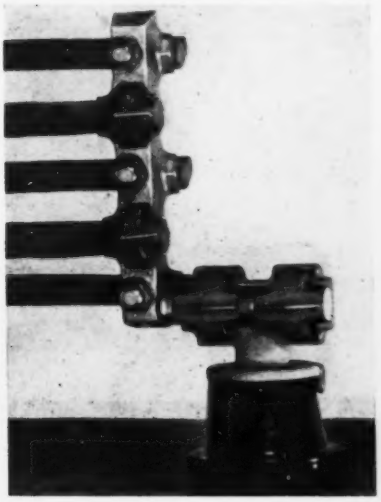
Also Available May be used on 1, 2 or 3-phase 3-wire services

Write direct to Duncan Electric for descriptive data and bulletins on Duncan Extended Range Polyphase Meters and High Capacity Mounting Devices.

DUNCAN ELECTRIC COMPANY, INC., Lafayette, Indiana

"THINKING AHEAD . . . MOVING AHEAD . . . TO STAY AHEAD OF DEMAND"

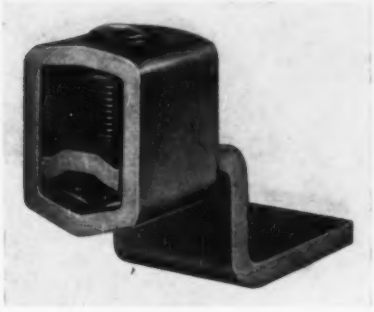
LIVE BETTER ELECTRICALLY WITH FULL HOUSEPOWER



Terminal Adapters

(12) *Anderson Electric Corp., 700 N. 44th St., Birmingham, Ala.*

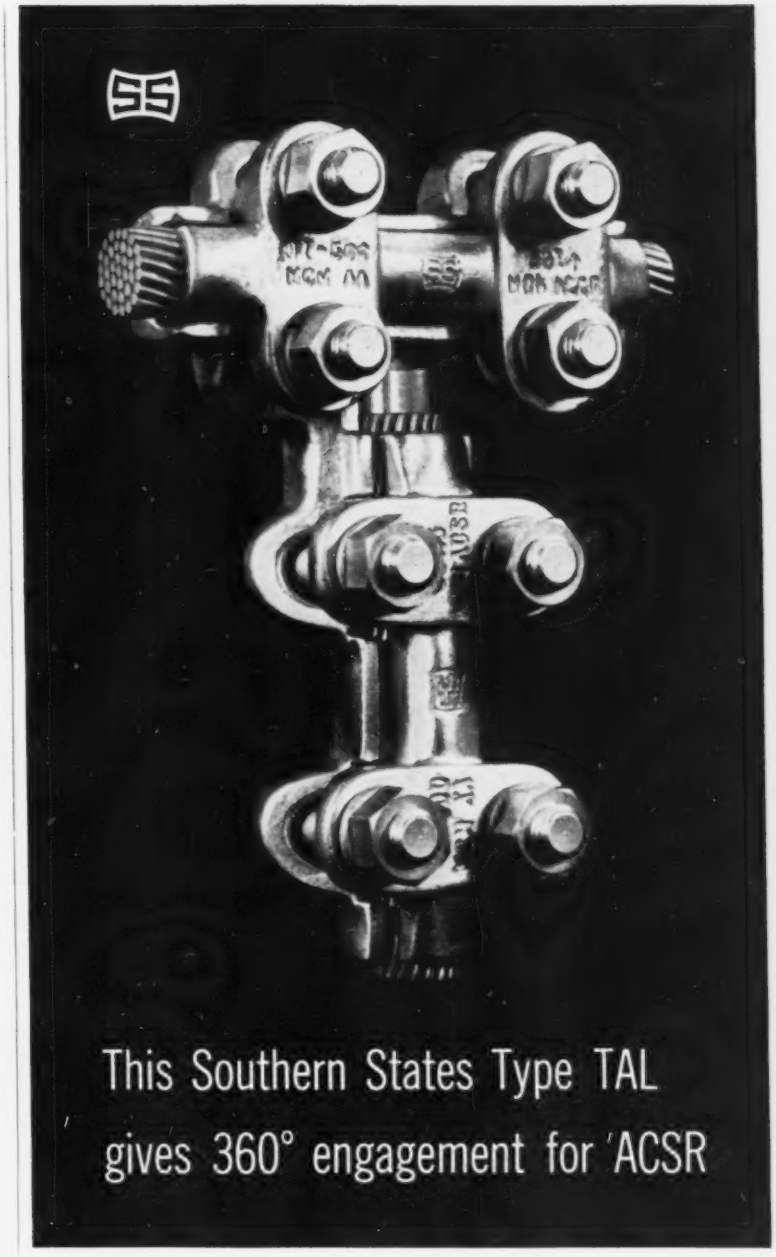
A new series of bronze multiple tap terminal adapters for distribution transformers has been developed by this company. The new adapters allow the use of two or more cable taps from each secondary terminal to eliminate excessive connections and taping. The use of several small cables instead of one large one also reduces the installation difficulty encountered when trying to bend a large cable in close bank coupling.



Solderless Lugs

(13) *Ilsco Corp., 5751 Marlemont, Cincinnati 1, Ohio.*

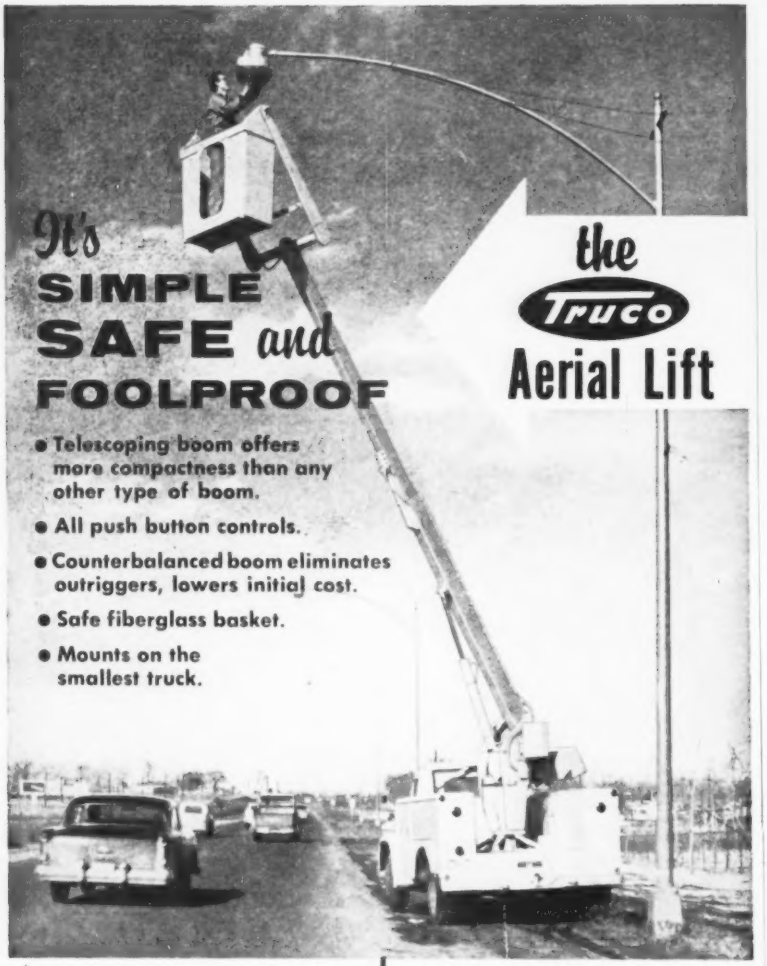
These new solderless lugs can be used for either copper or aluminum conductors. Features are high torque value, low heat rise, captive tang or tongue that cannot fall out and V-type serrated vise jaws for increased cable-holding strength.



The unique design features of this connector reflect the engineering behind the entire Southern States line of fittings. For instance, to assure good electrical and mechanical characteristics, it provides independent clamping on run and tap conductors; its maximum contact engagement minimizes conductor clamping stresses; and conductor-fitting grooves limit cable distortion.

SOUTHERN STATES
EQUIPMENT CORP.
HAMPTON, GEORGIA

IN CANADA Dominion Cutout Co., Ltd., Toronto



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Truco

Ask for name of nearest distributor

TRUCK Equipment COMPANY

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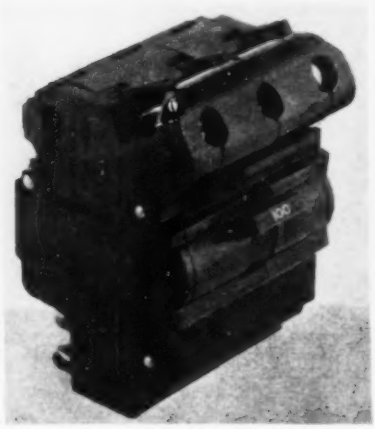


Circuit Breaker

(14) *Federal Pacific Electric Co., 50 Paris St., Newark, N. J.*

A new three-pole, 100-amp Stab-lok circuit breaker that is only 3 in. wide and one-third the size of comparably rated breakers is announced by this company. It can be used in combination with the rest of the Stab-lok line. It is dual rated for use as a plug-in main circuit breaker in a standard three-phase load center or as a branch circuit breaker in either a load center or NALP panelboard. Connectors are said to be listed for copper or aluminum conductors.

Expanding Anchors

(15) *Penn-Union Electric Corp., 315 State St., Erie, Pa.*

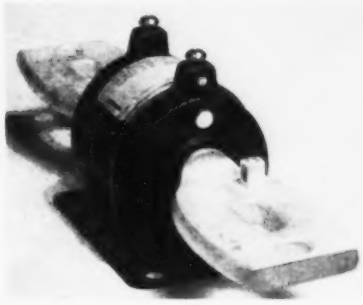
This company is offering a new expanding earth anchor that features four blades that are heavily flanged for rigidity and penetration into undisturbed earth. The anchors are available in eight different square-

inch sizes and in two different base sizes. They are specially coated to protect them from long periods in damp storage areas and against corrosive soil conditions.

Capped Connectors

(16) *Burndy Corp., Norwalk, Conn.*

To simplify the installation of electrical connectors filled with corrosion-inhibiting compound, this company supplies connectors of this type capped with yellow plastic plugs. The caps are said to provide cleaner, easier removal of the compound seal than the former adhesive tape.



Indoor Transformer

(17) *General Electric Co., Schenectady 5, N. Y.*

This company's meter department has developed a 600-v indoor current transformer that is said to be priced 40% lower than comparable indoor-outdoor models. It is available with either high base or low base, bar-type construction and in 200-, 400-, 600- and 800-amp ratings. Ratio and phase-angle corrections of the new transformer are said to be well within rated parallelograms.

Threading Dies

(18) *Nye Tool Co., 4120 W. Fullerton Ave., Chicago 39, Ill.*

This new line of threading dies is designed specifically for threading aluminum conduit. The new dies are said to have been especially engineered and developed with cutting teeth shaped and angled to meet requirements involved in aluminum threading. A complete range of sizes is available.

Use Coupon . . . . p 22

Subox Has a Paint For Every Need

If it's a steel tower, for power transmission or any other purpose, there are Subox paints for every protective and decorative requirement.

SUBOX are the only paints in the United States made with *suboxide of lead*. After drying, Subox continues to be chemically active to form a strong, impervious film. A single coat of Subox usually lasts five to eight years even under severe weather conditions.

SUBOX "600" SERIES contains an epoxy resin for increased chemical, alkali and water resistance. Gives added protection against corrosive fumes and extremes in temperature changes.

GALVANOX, with a high content of special metallic zinc, provides an electro-chemical type of protection. Not to be confused with ordinary zinc oxide paints, it is superior for reconditioning damaged galvanized surfaces.

AEROX is the name used to distinguish the orange and white Subox-made paint used for towers near airfields. It holds its brilliant visibility well under all conditions.

Write today for descriptive literature and color card.

SUBOX PAINTS

Subox Inc.

Established 1924

The Ambler Co. Denver, Colo.
R. E. Cunningham & Sons Los Angeles, Cal.
Wrathall & Krusi San Francisco, Cal.
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- Preformed Line Products Company
- Lotran, Inc.

3450 Wilshire Blvd., Los Angeles 5, Calif.
Phone: DU 1-3951 • TWX: LA-795

BULLETINS ETC.

(19) **CAPACITORS**—Construction features of Allis-Chalmers substation and pole-mounted power factor capacitors are described in a new bulletin. Write to the company at 1126 S. 70th St., Milwaukee 1, Wis. Ask for Bulletin 32B9421.

(20) **CONTROL CATALOG**—A new catalog listing the entire line of automatic controls for heating, refrigeration and air conditioning of White-Rodgers Co. is now available. It is the largest ever released by the company. Ask for Unit R-1650 from White-Rodgers Co., 1209 Cass Ave., St. Louis 6, Mo.

(21) **TRANSMISSION TOWER**—A two-color folder describing its design and manufacture of a 2-ft-square narrow base steel electrical transmission tower has been published by Anchor Metals, P. O. Box 148, Hurst, Texas. The folder gives the background and history of the design, drawings, specifications and illustrations of several applications of the towers now being used by utility firms.

(22) **FLUORESCENT FIXTURES**—Surface and pendant fluorescent lighting fixtures are described in a new brochure available from Lightolier Inc., 346 Claremont Ave., Jersey City, N. J.

(23) **RECORDERS**—Bulletin GEA-6933 available from General Electric Co., Schenectady 5, N. Y., gives buying information on the company's complete line of recording instruments. Photographs of all models discussed are included.

(24) **STACKING CROSSARMS**—A two-color poster illustrating the recommended method for stacking crossarms is now available from the West Coast Crossarm Assn., 332 S. Michigan Ave., Chicago 4, Ill. The poster is intended for display in storage areas.

(25) **LIGHTING STANDARDS**—Hubbard Aluminum Products Co., 200 S. Michigan Ave., Chicago 4, Ill., is offering a new 32-page catalog on its HAPCO line of aluminum alloy lighting standards. It includes illustrations of typical installations.

(26) **CONTROL CENTERS**—Bulletin P16200, published by Clark Controller Co., 1146 E. 152d St., Cleveland 10, Ohio, illustrates advantages and adaptability of a-c motor control centers and includes plan-it-yourself forms and instructions. It includes specifications, space requirement tables for control components and descriptions of Clark equipment designed for use in control centers.

(27) **CARRIER EQUIPMENT**—General Electric Co. has issued a new eight-page bulletin on transistorized carrier transmitters and receivers. The new publication, GEC-1537, describes equipment for transfer-trip relaying, telemetering, supervisory control, automatic dispatching, etc. Write to the company's Communication Products Department, Lynchburg, Va.

KILL TWO BIRDS WITH ONE STONE—Fill out this coupon and get back valuable information from as many sources as you indicate.

ELECTRICAL WEST
68 Post St., San Francisco 4, Calif.

Not good after February 1

Please send me, without obligation, the new product information or catalogs:

If described in Product News, circle item number

1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17 18 19 20 21 22 23 24 25 26 27

If described in advertising, fill in page number

☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

NAME ..... **TITLE** .....

COMPANY .....

ADDRESS .....

CITY ..... **ZONE** ..... **STATE** .....

*Please include your company's name and your position, as we cannot ask manufacturers to furnish literature unless you do.

NEW THUMB OPERATED CRIMPER

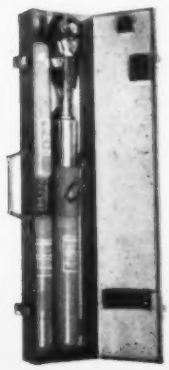
LEAVES ONE HAND FREE to handle conductor!

The new Chance CO_2 Compression Tool is operated with one hand, leaving the other hand free to position conductor and sleeve. Its replaceable CO_2 cylinder provides the power. With no more exertion than a press of the thumb, your lineman can crimp aluminum connectors and line taps.

The tool is simple to use, mistake-proof. A safety key locks the trigger. When ready to crimp the connector, pull the key, place the head of the tool over the sleeve, align it with the crimp marks, and squeeze the trigger. The tool will make a correct crimp, automatically, every time.

Made of heat-treated steel and aluminum, this light, well-balanced crimping tool handles any service connector or tap that uses ½", ¾", or C dies. All three sizes fit this one tool. The dies are easy to attach, and automatically seat themselves.

The tool can perform 50 to 70 operations before the CO_2 is exhausted. Empty cylinders can be replaced in seconds. They may be refilled at local CO_2 dealers, fire extinguisher services, or your own refill station. The tool needs only simple maintenance. Light oiling will keep it in tip-top shape.



So, make it easy for your linemen to make connections correctly . . . get the new Chance Compression Crimping Tool for service connections. We've given it Catalog Number CA-800. It, and two extra CO_2 cylinders, come packaged in a sturdy metal box. Ask your Chance Sales Representative for the whole story, or write us.

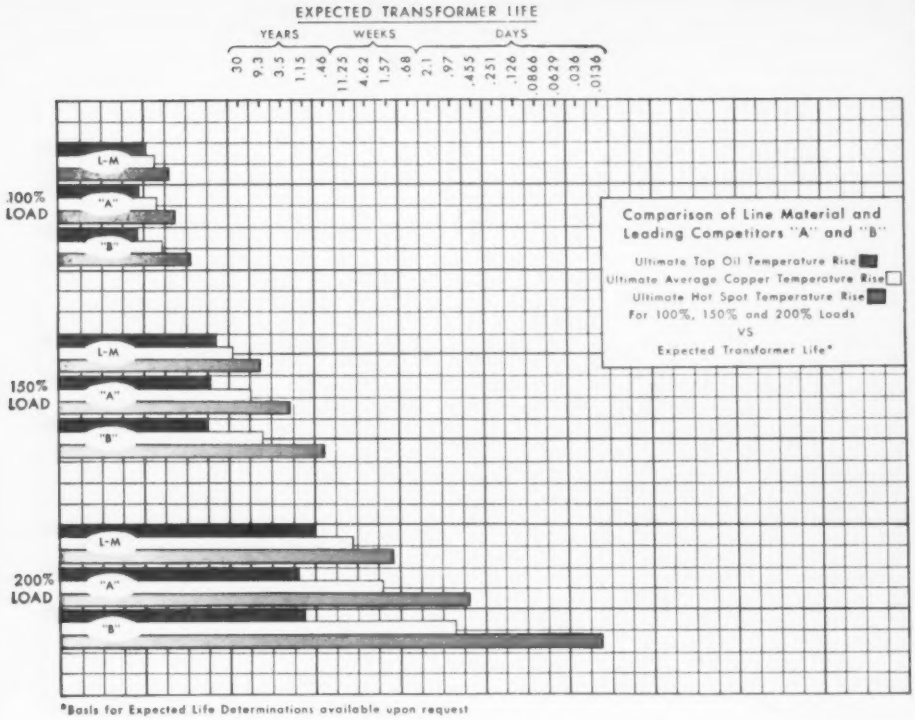
C159-27

A. B. CHANCE COMPANY

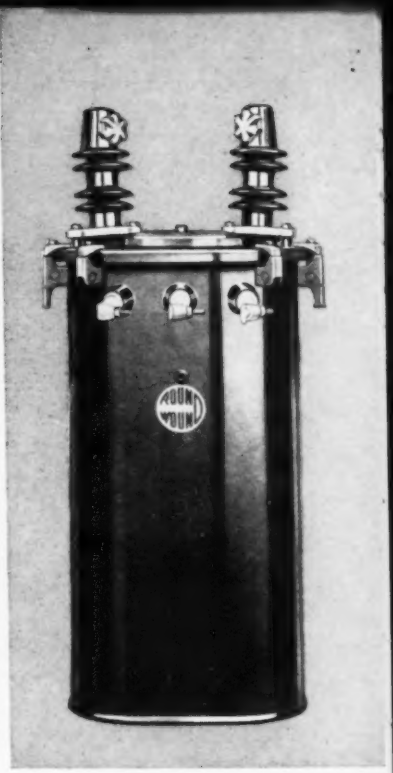
GENERAL OFFICES: CENTRALIA, MO.
A. B. CHANCE CO. OF CANADA, LTD., TORONTO

ABC INDUSTRIES

For phone number of closest representative see advertising index in back of book.



*Basis for Expected Life Determinations available upon request



BASED ON AIEE TRANSACTION PAPER, "Life Expectancy of Oil Immersed Insulation Structures," volume 72, pages 924-29, and laboratory tests, transformer life can be estimated by comparing bar length with scale at top. (Note: the longer the bar, the shorter the life.)

L-M Increases Secondary Breaker Setting

Low winding and insulation temperatures permit uprating L-M transformers without any sacrifice of transformer life expectancy.

by **A. R. WAEHNER**
Director
Transformer Product Sales
Line Material Industries

During the past year, much has been claimed about improved transformer insulating materials and systems. This has led to confusion and justified concern on the part of many users who are interested in the long life of distribution transformers.

The anticipated life of a transformer is not governed *solely* by the insulating materials used therein—but, just as importantly, by the temperatures at which they operate. The *design* of the core and coil structure that permits the *most rapid removal* of the heat generated within the winding results in the lowest insulation temperature.

Rapid extraction of heat from the vulnerable areas of the coil reduces the internal copper temperature that causes insulation deterioration, thereby extending life expectancy.

High Top Oil Temperature

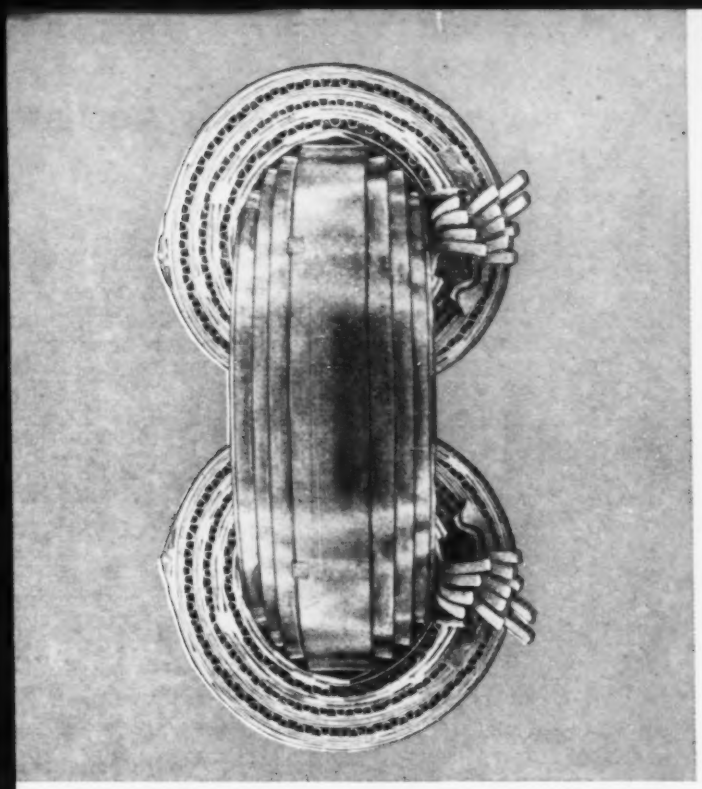
The inherent characteristics of the Line Material Round-Wound® design create *higher* top oil temperatures and lower copper temperatures than in other designs with the same total losses. This is an *advantage* and not a *disadvantage*, as it proves the rapid removal of internally generated heat. Just as hot beverages placed in a thermos jug cool slowly, in like manner other designs of cores and coils restrict the release of generated heat to a greater degree than in the Round-Wound design. Because we transfer heat to the oil more rapidly, the Round-Wound hot spot temperature is reduced, overload capacity is increased, insulation is not jeopardized, and life expectancy is extended.

Another advantage of higher top oil temperature is the more rapid dissipation of transformer heat because of the *higher* gradient between tank wall and ambient temperature of the surrounding atmosphere.

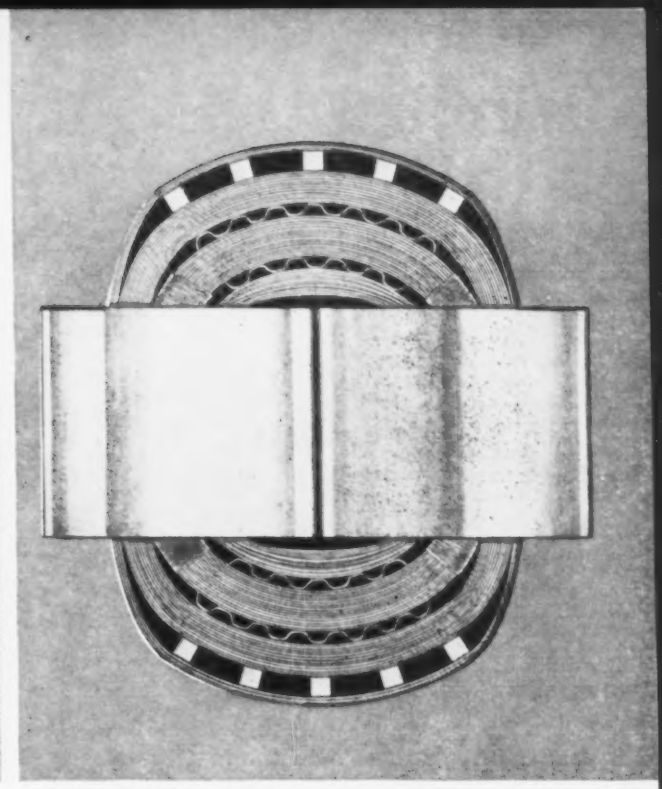
The illustrations on these pages clearly reveal a vastly greater percentage area of coil exposure to cooling oil than in competitive designs. Note, also, the many strategically located cooling ducts.

Low Temperature Gradient

Fast heat transfer in a Round-Wound core and coil rapidly raises top oil temperature *closer* to the hot spot temperature. The degrees difference is known as "temperature gradient" and is lower in the Round-Wound design than in any other make of core or shell type transformer available today. Low temperature gradient is a most significant factor contributing to long transformer life,



THIS END VIEW shows how L-M's exclusive Round-Wound design permits more oil ducts and exposes maximum cooling surface area. Winding heat is transferred more effectively than by other designs.



THIS END VIEW shows how shell type window dimensions prohibit oil ducts on the inside where heat build-ups occur. Only L-M's Round-Wound design provides concentric cooling.

on Round-Wound-Protected Transformers

especially at times of heavy overload when transformers are most vulnerable to high insulation temperatures. To take the ideal condition, if the gradient were zero degrees, heat would transfer instantly, top oil temperature would be higher, hot spot temperature would be lower, and the ultimate in life expectancy would be attained.

Laboratory tests of modern competitive samples compared with the Round-Wound design prove conclusively that at periods of heavy overload, the Round-Wound hot spot temperature is lower than with any other modern competitive design. In fact, it is *less* than the average copper temperature of at least one leading make of transformer. This is dramatically revealed in C. R. Acker's technical article in the September-October, 1959 issue of THE LINE Magazine.

Continuing Research

As a pioneer in long insulation life, Line Material, in 1951, was the first manufacturer to introduce oxidation resistant transformer oil (ORTO®). Our research and design engineers, with the assistance of Thomas A. Edison Laboratories, maintain a continuing search for improved insulation systems. If and when we find a better system, we will adopt it. The insulation system employed in the Round-Wound design, since its inception, is the finest available. The Round-Wound transformer you buy today will provide equal or greater life, under any comparable loading conditions, than any other transformer available in the industry today, *without* the necessity of a design change.

Higher Secondary Breaker Settings

Throughout the years, our Round-Wound units have enjoyed liberal overload capacity with breaker settings in line with those dictated by the current usage in the industry. Our RWP® breaker settings have been recalibrated to be as high as or higher than those offered by any other major manufacturer today. Transformers with this new breaker calibration will be identified with this symbol ‡ following the Kva designation.

The same confidence in the longevity of Round-Wound conventional transformers may be expected because the core-and-coil designs are identical.

Get Complete Information

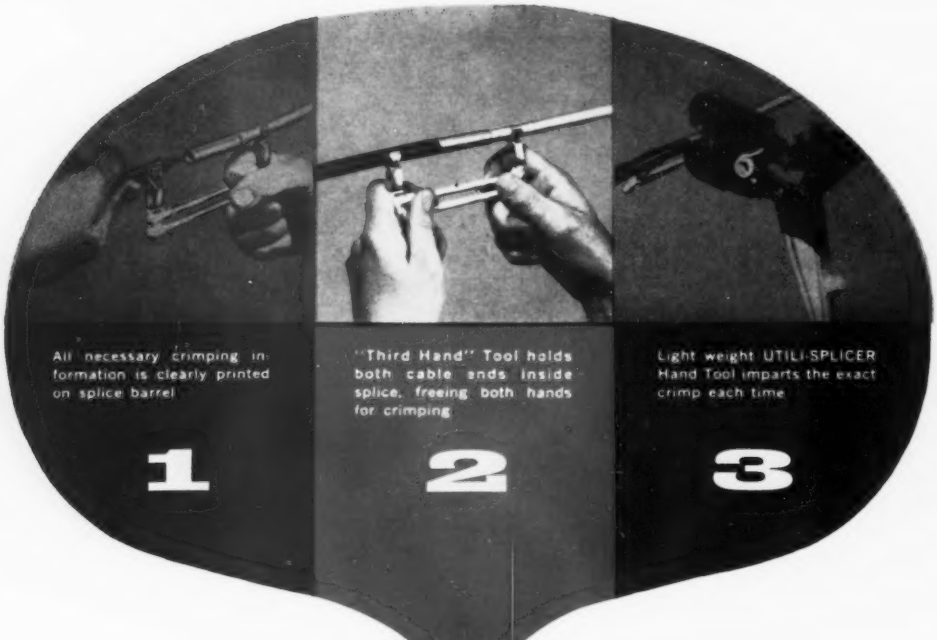
Ask your L-M Field Engineer for the complete story on why the RWP transformer can have increased secondary breaker settings without a new design or without new insulation. Or write me at Line Material Industries, Milwaukee 1, Wisconsin.

LINE MATERIAL Industries *Transformers*

McGRAW-EDISON COMPANY

DISTRIBUTION TRANSFORMERS • KYLE RECLOSERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS
POWER SWITCHING EQUIPMENT • PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING
LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

422


All necessary crimping information is clearly printed on splice barrel
1
"Third Hand" Tool holds both cable ends inside splice, freeing both hands for crimping
2
Light weight UTILI-SPLICER Hand Tool imparts the exact crimp each time
3

SIMPLICITY!

Now, the AMP Step-Down UTILI-SPLICE, combined with the new light weight crimping tool and the "Third Hand" Tool, give you still greater economies in your step down splices, savings in man-hours plus AMP's reliable attachment method. For all stranded, solid or ACSR conductor combinations in copper and/or aluminum . . . wire size range #8 through #1/0 AWG.

Send for more information today.

CHECK OFF THESE ADDITIONAL HIGHLIGHTS:

- **long-life corrosion resistance from special tin plating and from inhibitor-sealing compound that pre-cleans contact surfaces**
- **splice lengths proportioned to the cross section of cable**
- **optimum heat dissipation**
- **wire-stops assure proper insertion depth of stripped cable**
- **maintenance free**

American Pamcor, Inc.

GENERAL OFFICES: 181 HILLCREST AVE., HAVERTOWN, PA.

Exclusive Distributor For AMP Products To The Utility Industry

For phone number of closest representative see advertising index in back of book.

3 NEW G-E MOTORS AND 42 QUALITY IMPROVEMENTS

A family appearance in power station motors and 42 basic design improvements are now available from General Electric. The three new enclosures shown here enable electric utilities to select power station motors with the same modern appearance. And all of these new motors contain the same advanced features, painstakingly engineered to meet electric utility standards of reliability.

Among the 42 quality improvements available on all G-E boiler feed pump motors, are:

- **Polyseal* insulation system**—sealed against moisture; resists fly ash, most other abrasives.
- **Patented tying system**—heat hardened Permafil glass rovings hold end turns of form wound coils in a vise-like grip for maximum support.
- **Rugged frames**—provide added rigidity and strength required for power station service.
- **Extremely low noise level**—now possible with proven acoustic treatment.
- **Stator connections**—all brazed for more uniform strength, reliability.
- **Controlled slot wedging**—provides tight, stable fit, virtually eliminates coil looseness and resultant wear.

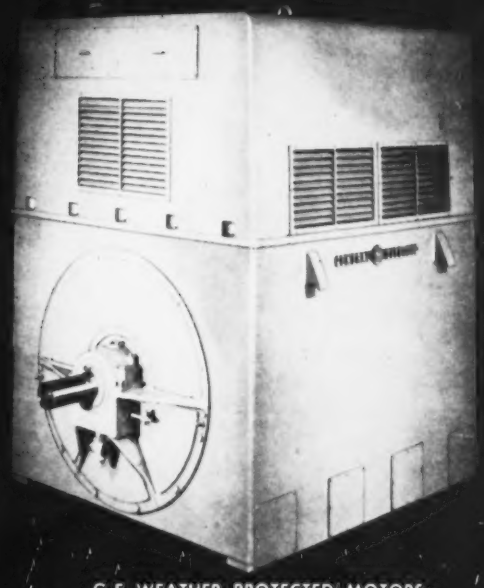
FOR THE COMPLETE STORY on G.E.'s 3 new power station motors and 42 quality improvements, contact your G-E Apparatus Sales engineer or write Section 884-3, General Electric Co., Schenectady 5, New York.

*Trademark of General Electric Co.

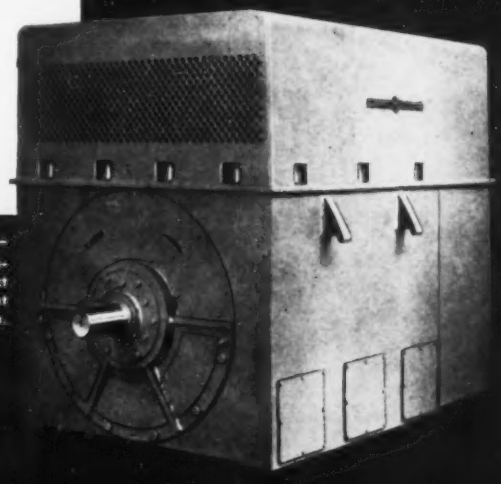
Progress Is Our Most Important Product

GENERAL ELECTRIC

BOILER FEED PUMP MOTORS—
Large 2-pole drippproof motors are acoustically treated for quiet operation—give long, reliable service.



G-E WEATHER PROTECTED MOTORS—
give better protection against rain, snow—even hurricanes—exceed NEMA Type II definition.



G-E TUBE-COOLED TEFC MOTORS—
are designed for easy disassembly, maintenance and inspection; computers select optimum number, size and arrangement of tubes for most effective ventilation.

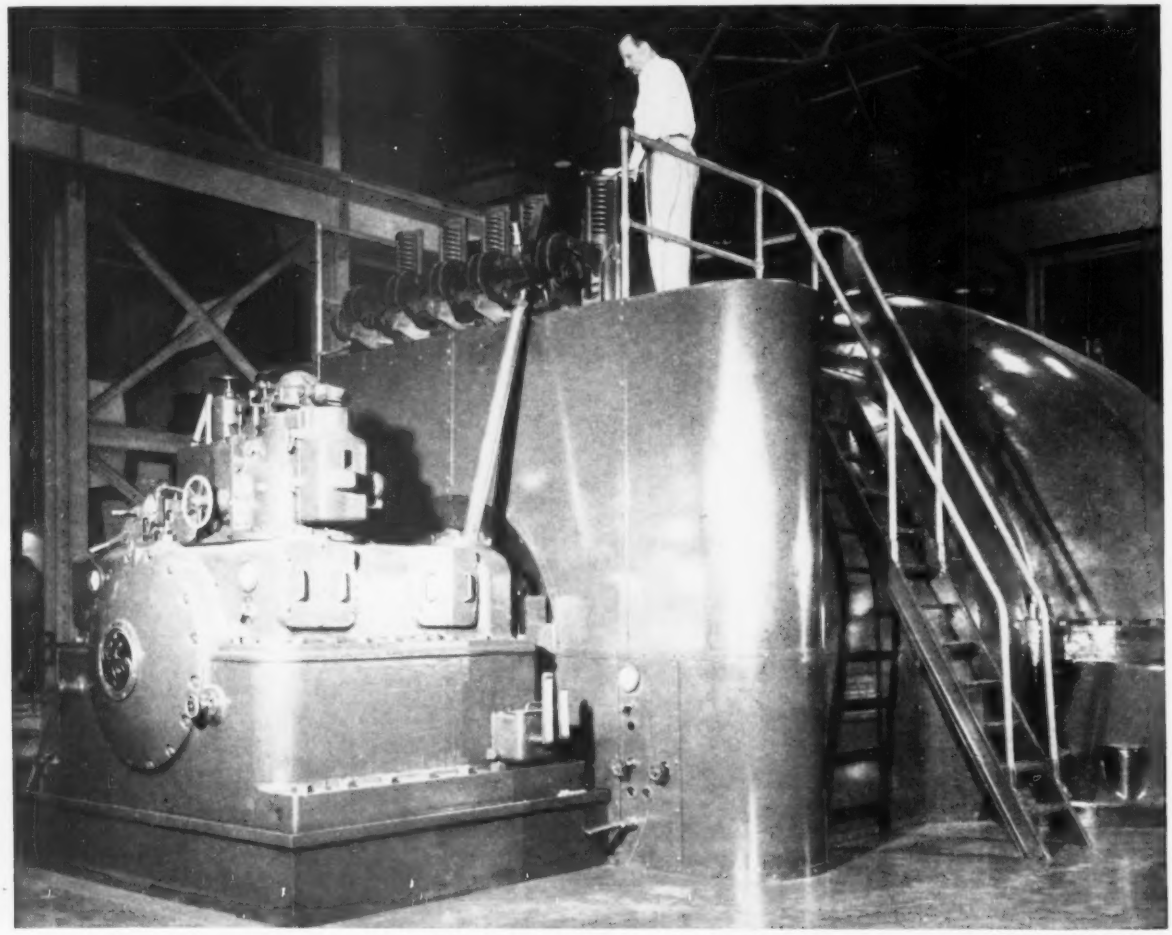
another G-E PROJECT '8000' development

PROJECT '8000'—
a major General Electric program of research, product redesign, advanced manufacturing and improved customer service on a-c motors 150- to 6000-hp.

STANDARD ENGINEER'S FIELD REPORT

LUBRICANT	CHEVRON* OC TURBINE OIL
FIRM	U.S. STEEL CORP. Geneva, Utah

Oil Neutralization No. only .07 after 100,000 hours



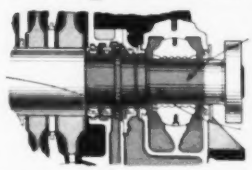
Chevron* OC Turbine Oil is used in this General Electric turbine which is the principal source of power for United States Steel Corporation's mill at Geneva, Utah. After 100,000 hours operation the oil in this 50,000-kw turbine-generator showed a neutralization number of just .07—identical with the number of the original 7,000 gallon charge made in 1943. During regular inspection and servicing periods, the oil was drained, purified, and put back in service. No "sweetening" of the oil, and no other down time was required during the entire 100,000 hour period. Chevron OC Turbine Oil is also used in mill's four 11,350 hp turbo-blowers.

For More Information about Chevron OC Turbine Oils call your Standard Representative, or write 225 Bush Street, San Francisco 20, California.

*The Chevron Brand covers the line of industrial products formerly sold under the Calol name. This is a name change only. The high quality and specifications remain the same.

TRADEMARK "CHEVRON" AND REG. U.S. PAT. OFF.

Why Chevron* OC Turbine Oil prevents sludging, rusting and wear



- Excellent metal wetting ability keeps oil on bearings and gears under heaviest loads
- Oxidation inhibitor prevents sludge, gum, and lacquer formations
- Corrosion inhibitor stops rusting

CHEVRON Industrial Lubricants

STANDARD OIL COMPANY OF CALIFORNIA

For phone number of closest representative see advertising index in back of book.

FIVE NEW GEDNEY PRODUCTS . . .

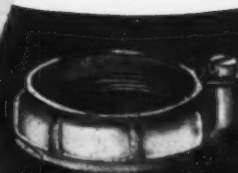
"that fit always!"

Nobody knows better than you do how much time, trouble and expense are involved when electrical fittings don't fit properly. That's why Gedney has adopted the simplest of mottoes: *Gedney Fittings fit.* And we mean it!

Gedney Fittings are machined with unfailing accuracy, then carefully finished, finally they're scrupulously inspected. *Result?* You no longer have to make allowances for the fittings (and time) you used to throw away! One more thing. These better fittings cost you no more!

Think of all the places you can save time and money with these five new Gedney Fittings and Accessories!

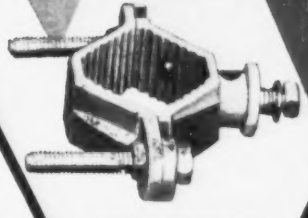
GEDNEY INSULATED MALLEABLE IRON BUSHINGS
(cadmium-plated). Polyethylene collar is free to turn while bushing is tightened...prevents binding, twisting, during installation. Sizes ½" to 6".



GEDNEY JUMPER WIRE BONDING BUSHING
Solderless lug. Malleable iron, cadmium-plated, available sizes ½" to 4".

GEDNEY INSULATED MALLEABLE IRON GROUND BUSHINGS
(cadmium-plated). Solderless lug. Free-turning polyethlyene collar prevents binding, twisting, of conductors. Sizes ½" to 4".

GEDNEY PUSH-PULL TAB CAP.
For plugging bushings, etc. Use again and again. Strong polyethylene, in sizes ½" to 2".



GEDNEY STATIC PREVENTIVE GROUND CLAMPS.
Made to ground pipe or conduit from ½" to 8".

GEDNEY FITTINGS FIT

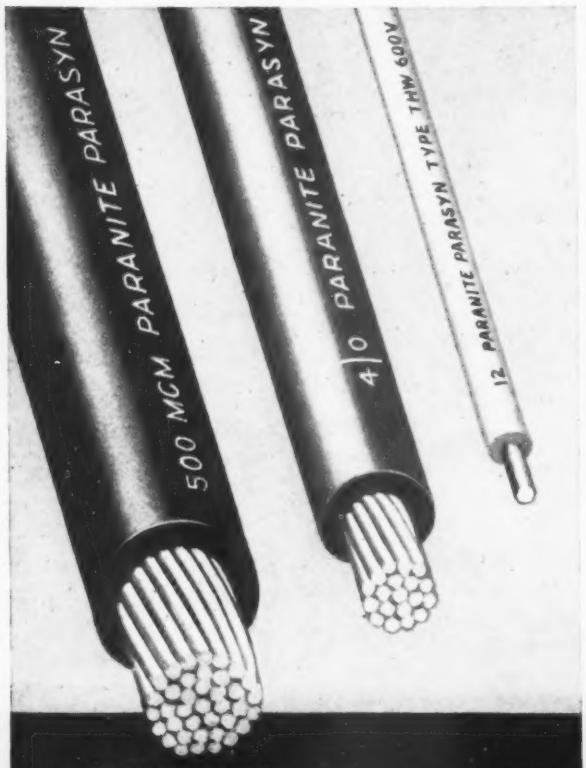
GEDNEY
ELECTRIC COMPANY

RKO BLDG. • RADIO CITY • NEW YORK 20
Foundry, Factory and Shipping Point: Terryville, Conn.

For phone number of closest representative see advertising index in back of book.

PARANITE THW and RHW

Two types available for 75°C wet or dry specified applications



NEW! PARASYN® TYPE

THW

THERMOPLASTIC INSULATED
600 V BUILDING WIRE

New UL listed 75°C building wire for wet or dry applications. Specially formulated Paranite vinyl insulation. Small diameters, slick silicone finish, color availability and stripping ease all contribute to reducing handling costs!

MYLAR TAPED*
PARATEMP® TYPE

RHW

600 V BUILDING WIRE

Taped with * Dupont "Mylar" (AWG 6 and larger) to provide an improved moisture barrier with higher dielectric strength. Resulting diameter reductions, better fit conduit. Saturated and impregnated, braided sheath, lubricated with special waxes to reduce pulling resistance.

Both UL listed 75°C wet or dry location

Here are two improved building wire products—both offering you outstanding performance in similar installations. Standard colors available from stock in both solid and stranded, sizes 14 AWG through 500 MCM for the THW . . . and 14 AWG through 1000 MCM for the RHW. Get acquainted with advantages of both wires—write today for complete technical information!

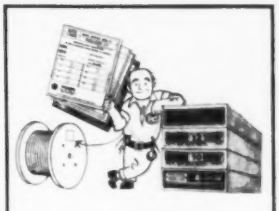
PARANITE WIRE AND CABLE DIVISION

Essex Wire Corporation, Marion, Indiana

Sold only through recognized electrical distributors

MANUFACTURING PLANTS: Marion, Ind.; Jonesboro, Ind.; Tiffin, Ohio; Anaheim, Calif.

Sales Offices and Redistribution Warehouses in all Principal Cities



Each Carton packaged to reduce handling and labor cost with "color-coded" labels plainly showing type, size and color of wire. Also, new reel cards for instant identification and inventory control.

For phone number of closest representative see advertising index in back of book.

To increase your sales of outdoor lighting

The NEW Mind-O-Light®

Completely Automatic!

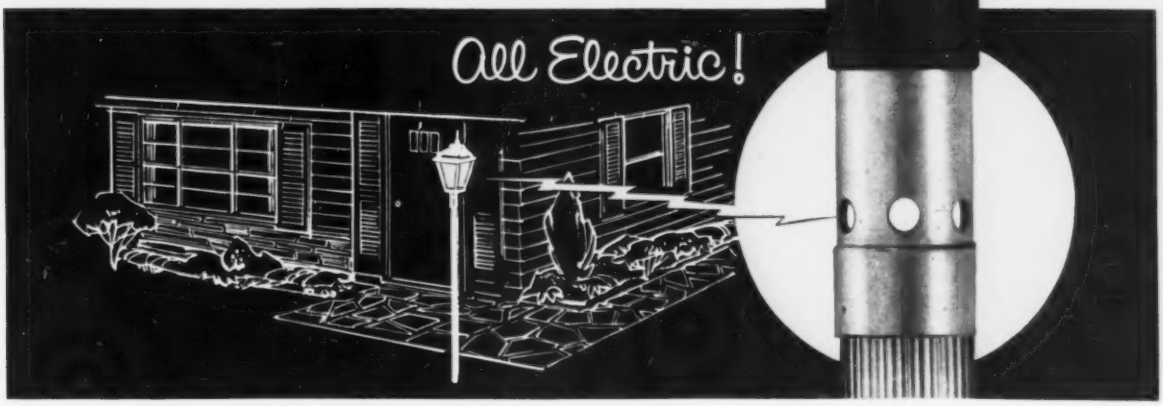
It turns post lights ON at dusk...OFF at dawn!

Union Made
UL Approved

Now increase your lighting sales, sell bigger and more profitable jobs, with the new Virden Mind-O-Light. Easily installed on any new or existing standard 3" post . . . with 3" O.D. post light, the new Virden Mind-O-Light automatically turns the lights *on* at dusk. It provides illumination and protection all night long when it is needed, turns the lights *off* at dawn, when it's not. Completely electrical, it is installed by electricians. Doesn't waste current. Perfectly safe.

Quality made by Virden, from the finest materials, it is fully guaranteed for one year. 5 amp. rating. Available in aluminum or black finish, with or without convenience outlet. Requires no orientation. Over-controlled with inside switch.

Your Virden distributor has the Mind-O-Light in stock now. Or mail the coupon below for full details plus a complete showing of the new Virden post lights and posts.



Another "light idea" from

virden
LIGHTING

A division of the John C. Virden Co., Cleveland, Ohio
In Canada, John C. Virden Ltd., Toronto, Ontario.
Member American Home Lighting Institute

Virden Lighting, Dept. ELW
5209 Euclid Ave., Cleveland 3, Ohio

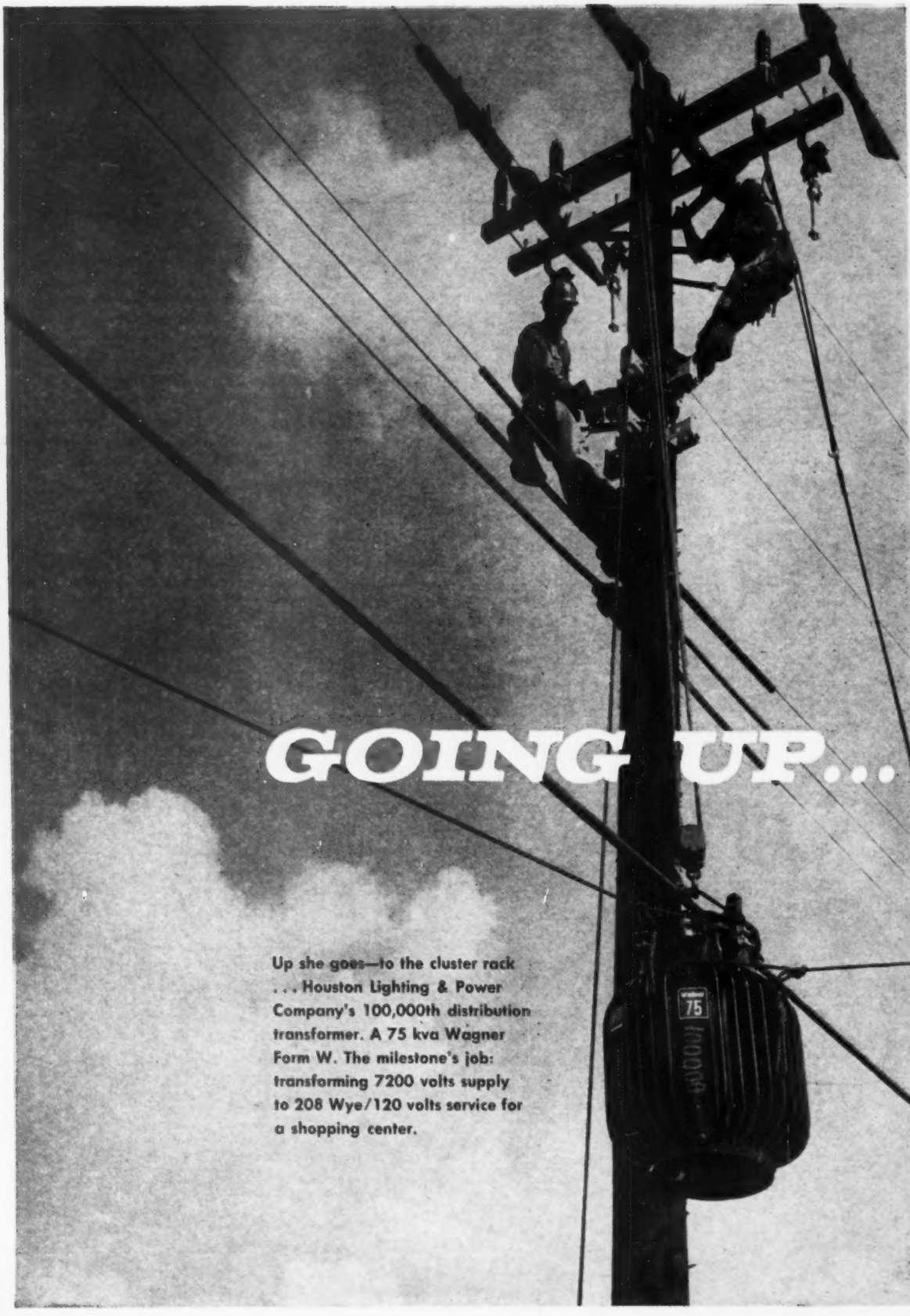
I want to know more about your Mind-O-Light. Please send me complete details. (Brochure 124)

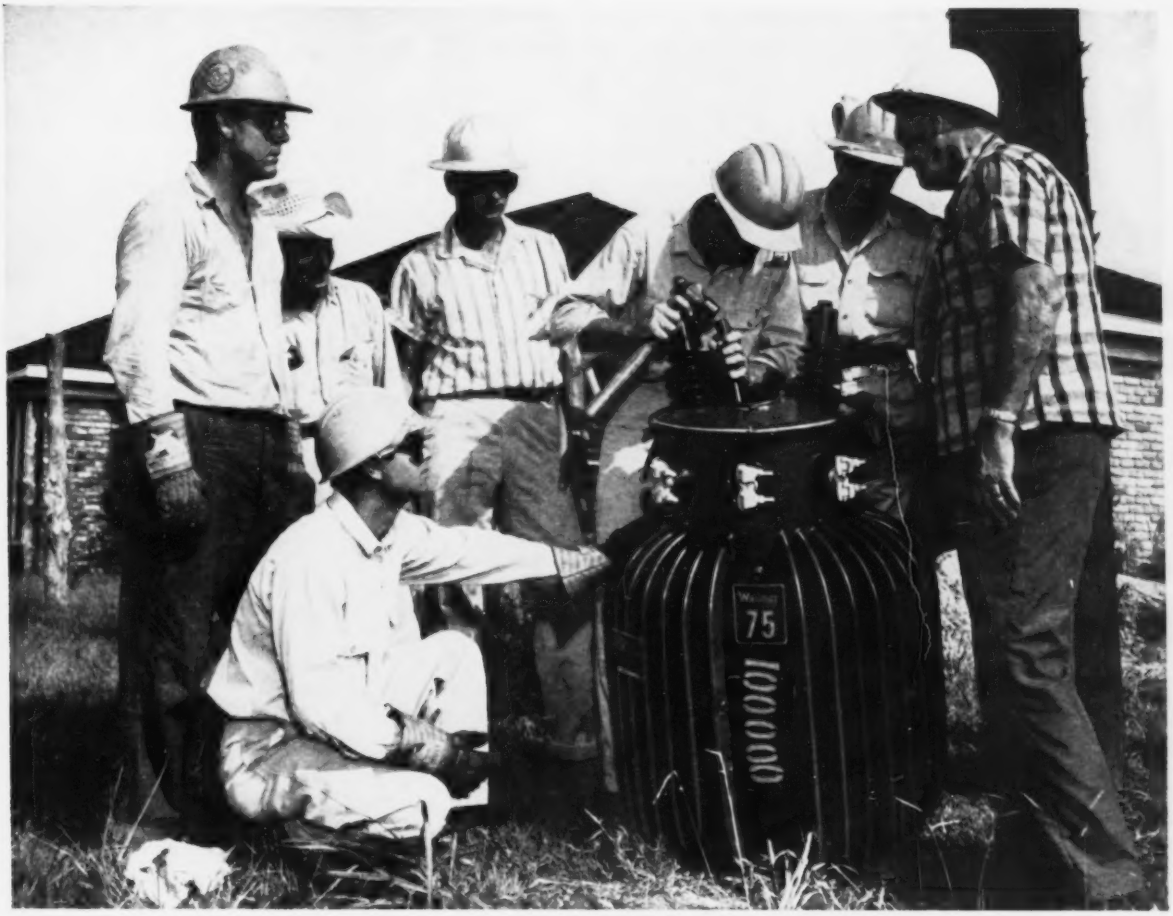
Name_____

Address_____

City_____ Zone____ State_____

® John C. Virden Co.


GOING UP...
Up she goes—to the cluster rack . . . Houston Lighting & Power Company's 100,000th distribution transformer. A 75 kva Wagner Form W. The milestone's job: transforming 7200 volts supply to 208 Wye/120 volts service for a shopping center.
75



a Houston milestone

100,000th distribution transformer goes into service . . . IT'S A WAGNER!

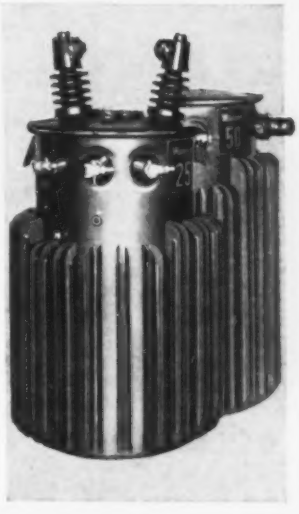
One hundred thousand distribution transformers. Tangible evidence, these, of Houston Lighting & Power's ever-expanding service to a 5,600 square mile area that is "busting out all over" at a record-breaking rate.

Check this: the utility serves a population that is growing twice as fast as the national average. Last year its ledgers listed 450,995 customers, over seven billion kilowatt hours of power were sold. KWH sales per residential customer averaged 4,641, compared to a national average of less than 3,500. The company's generating capacity is at the two and one-quarter million kilowatt mark . . . will be up to three million kilowatts by 1961.

Small wonder that Houston Lighting & Power is one of the country's top fifty utilities. Small wonder, too, that we're pleased that a Wagner transformer marked a milestone for the company.

Wagner Form W pole-type transformers in ratings 3 to 167 kva are available from factory, branch and distributor stocks. They are designed to meet all electrical requirements of modern overhead distribution systems: high efficiency, low exciting current, low impedance, high short circuit and overload capability. They have mechanical features that give you easy installation, safe operation and long service life.

Consult your nearby Wagner Sales Engineer about your transformer requirements, or write us. Soon.



BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

Wagner Electric Corporation

6381 PLYMOUTH AVENUE, ST. LOUIS 33, MO.

WT59-17

For phone number of closest representative see advertising index in back of book.

All your kitchen appliances will be clean, cool electric appliances in a Medallion Home

An all-electric kitchen is just one of the advantages you'll find in a home bearing the Medallion Home award

Every Medallion Home guarantees you:

1. An all-electric kitchen, with major electric appliances such as a modern range and oven ... all part of the basic home plan and price.

2. Full Housepower wiring for present, and future needs to handle the appliances you own today *plus* those you'll want tomorrow.

3. Provisions for proper lighting in all areas where it's needed to insure your family's safety and comfort.

And, for the ultimate in luxury living, there's the **all-electric** home—the Gold Medallion Home with a modern electric heating system such as the amazing electric heat pump that both heats *and* cools.

Always remember ... look for the Medallion award before you buy *any* new home.

SOUTHERN CALIFORNIA Edison COMPANY *helps you* LIVE BETTER—ELECTRICALLY

DISTRIBUTION

Equipment News

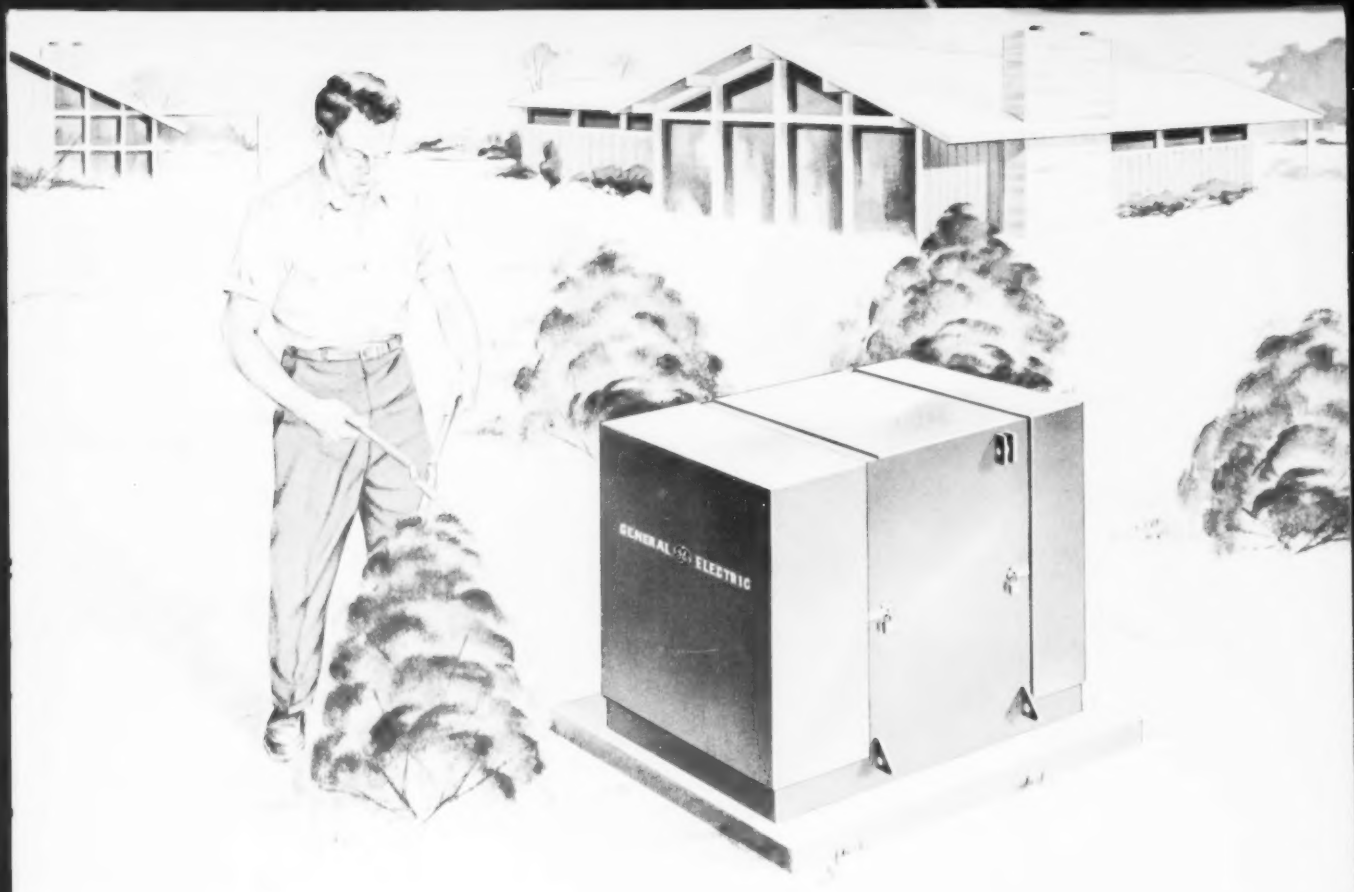
J. L. ELROD, Manager — Marketing, Distribution Transformer Department, introduces the new pad-mounted transformer.

NEW Pad-mounted transformers for residential underground systems

Plus . . .

- *NEW* simplified-design distribution transformers through 500 kva
- *NEW* Nitrile gasket seals on network transformers
- *NEW* corrosion-resistant transformer finish for seacoast installations

GENERAL ELECTRIC



NEW Pad-mounted transformers for suburban areas

To meet the ever-growing trend toward underground distribution systems in suburban areas, General Electric has developed a new pad-mounted distribution transformer.

General Electric's double-ended design is unique in that it has separate compartments for the high- and low-voltage terminals. This makes servicing easier and provides maximum safety for maintenance personnel.

Available in single-phase ratings from 25 to 100 kva, the unit presents a compact, attractive appearance that easily blends into neighborhood surroundings.

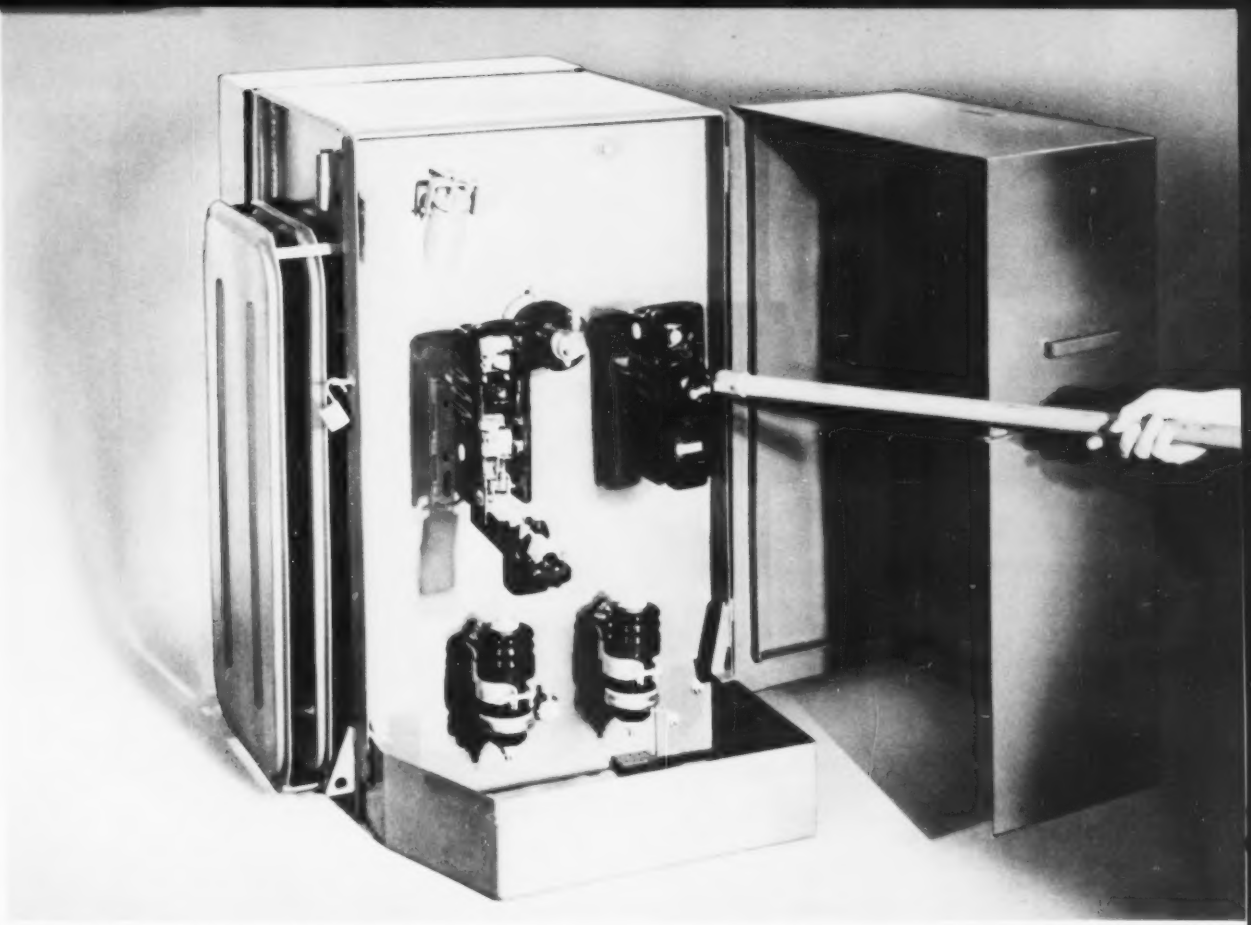
An outstanding safety feature of this new transformer design is the *positive visual* indication of the circuit condition provided by the two solid-blade load-break cutouts. When a cutout is open, the lineman has visible proof that the cable loop is completely isolated from the high-voltage source.

IMPORTANT NEW FEATURES OF G-E PAD-MOUNTED TRANSFORMERS

Simplified Installation — General Electric's pad-mounted transformers are the smallest, most compact transformers of this type available. In addition, all ratings of G-E pad-mounted units fit on the same size pad, with the same terminal connections. These features greatly simplify installation and allow future uprating with a minimum of time and expense.

Ease of Service — The high- and low-voltage components are contained in separate compartments on opposite ends of the transformer. Maximum use is thus made of available space, providing plenty of room for making connections or performing routine maintenance.

Accurate Service Reconnection — The bushings contained in the low-voltage compartment of pad-mounted units have two removable copper busses which are standard for all transformer ratings. Transformers can therefore be changed out to larger ratings without removing individual customer service connection from the busses — eliminating possible reconnection errors.



HIGH-VOLTAGE end view of a new 100-kva G-E pad-mounted transformer shows roomy compartment. One enclosed cutout is in open position. Second cutout is being opened with switchstick. This switching method clearly shows when unit is isolated from high voltage. Device at upper left holds high-voltage fuse. Two lightning arresters, optional equipment, are shown at bottom. No special housings or fences are required to make units tamper-proof.

Semi-buried transformer enclosures

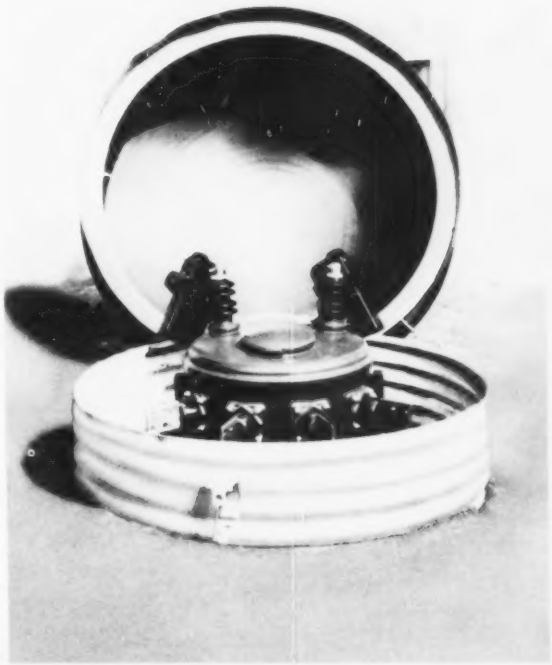
General Electric's semi-buried distribution transformer enclosure provides a safe and economical method of supplying power to modern pole-free residential developments.

The enclosure accommodates standard pole-type transformers through 167 kva, with plenty of room left for adding disconnects. Thus, linemen experienced in overhead system practices can easily make connections. General Electric's semi-buried installation can also be easily uprated by merely replacing the transformer.

The 54-inch diameter enclosure is designed for mounting on 48-inch corrugated culvert pipe. The hinged cover projects only 33 inches above the ground.

Vent openings are completely baffled for safety of children and for the protection of the transformer against small animals. The all-steel enclosure easily withstands the rigors of field installation and the onslaught of neighborhood children.

GENERAL ELECTRIC



NEW G-E 333 and 500 KVA distribution transformers

Simplified-design transformers replace station-type construction

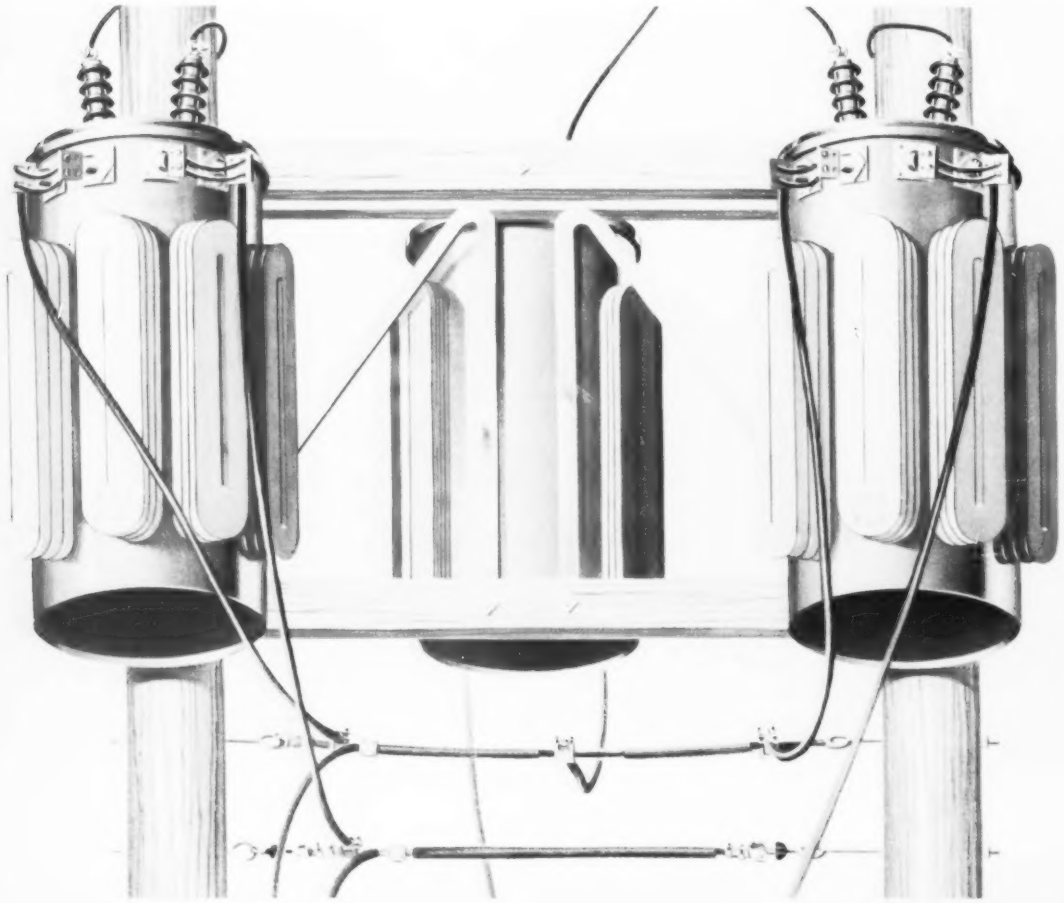
A complete line of General Electric simplified-design distribution transformers is now available through 500 kva. The new 333- and 500-kva ratings stem from an extension of G-E design techniques which previously resulted in the 167- and 250-kva pole-type units. This complete line of simplified-design transformers replaces former station-type units in these higher kva ratings.

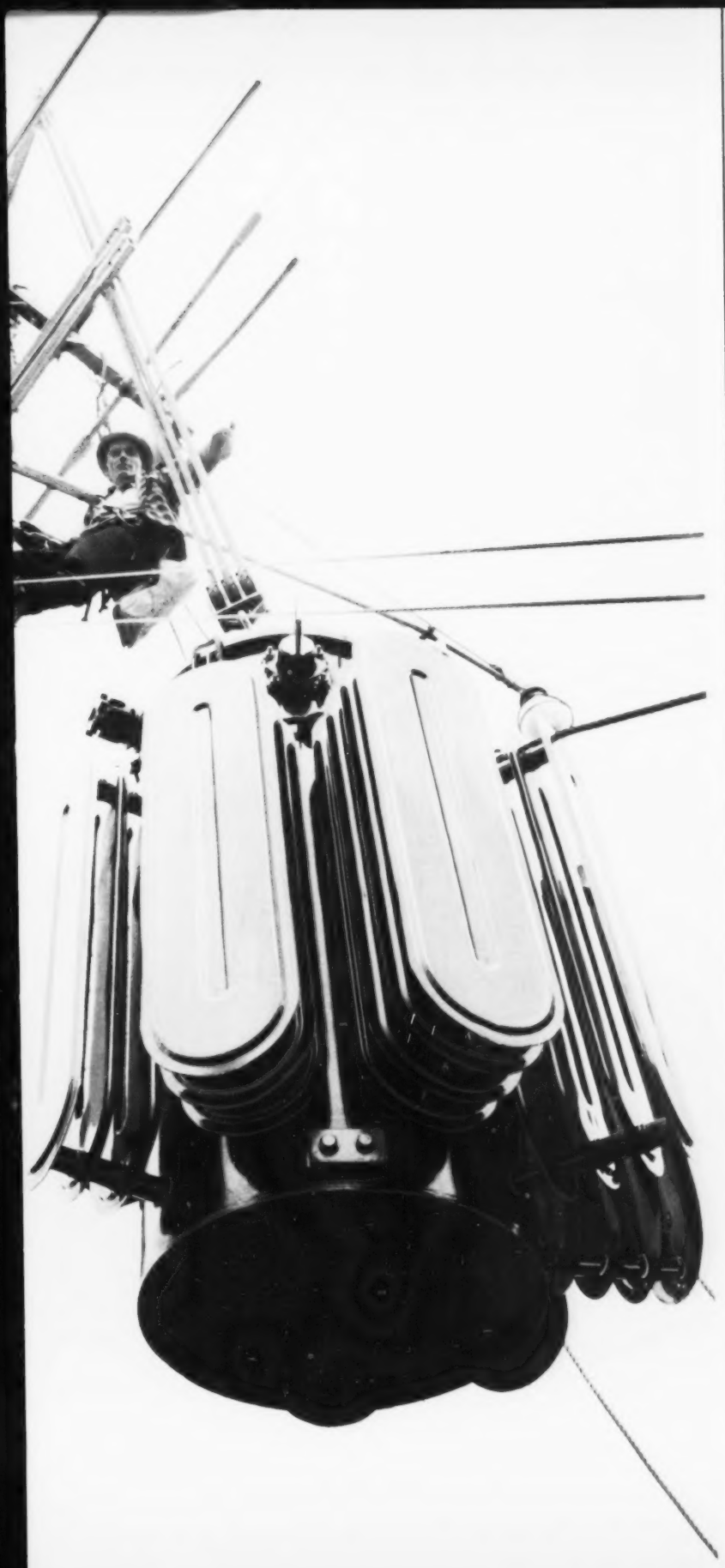
The new transformers retain all of the operating advantages of the former station-type design, yet provide significant savings to users through lower initial price and reduced installation cost.

The new G-E simplified-design units are available in single- or three-phase ratings. They replace station-type transformers having primary voltages below 15 kv.

GENERAL ELECTRIC

ARTIST'S ILLUSTRATION shows new approach to serving 1000-kva three-phase loads such as shopping centers or small industrials. Three new General Electric simplified-design 333-kva single-phase transformers shown below replace larger, heavier, more expensive station-type transformers.





Why We Developed These New Ratings

by

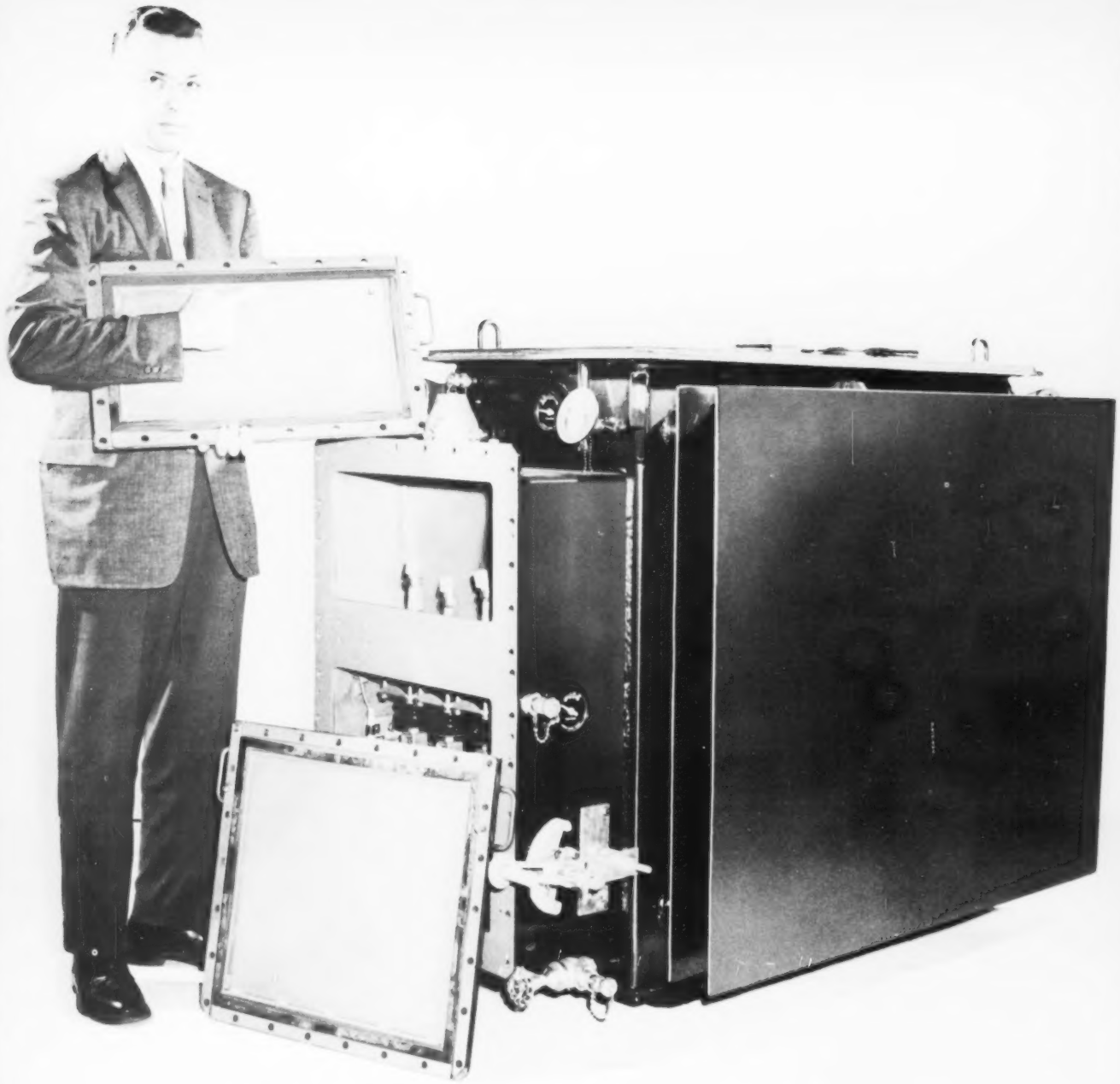
J. O. SWEENY, Manager — Product Planning, Distribution Transformer Department

Distribution transformers in ratings through 500 kva have long been classified into two general categories—pole type and station type. Only ten years ago, station-type units were predominantly for substation application. Illustrative of this, in 1949 over 70 percent of transformers purchased in the range of 167 through 500 kva had primary voltage ratings above 25 kv and secondary ratings above 2 kv. Today, over 80 percent are purchased for stepping down from distribution voltages below 15 kv to utilization voltages such as 240/480 volts. This change in application implies a lesser need for accessories which are standard in substation service. Also implied is a need for more versatile mounting arrangements.

Some time ago, the 167-kva transformer became a pole-type unit. More recently, the 250-kva rating was redesigned along pole-type lines. These changes have received enthusiastic acceptance. It is evident that the time has come for extending these benefits throughout the range of distribution transformers. In recognition of this, both the 333- and 500-kva ratings are being offered without station-type accessories. In addition, the 333-kva rating has been redesigned as a lighter-weight, more compact unit suitable for pole or platform mounting. A similar redesign of the 500-kva rating is underway.

These changes, applied to both single- and three-phase transformers through 15 kv and 500 kva, establish a compatibility between equipment and application requirements. Advantages include cleaner designs, dollars savings in both first-cost and installation costs, and greater versatility of mounting. The same high standard of reliable performance associated with General Electric's small distribution transformers will be maintained in this new larger distribution transformer line.

GENERAL ELECTRIC



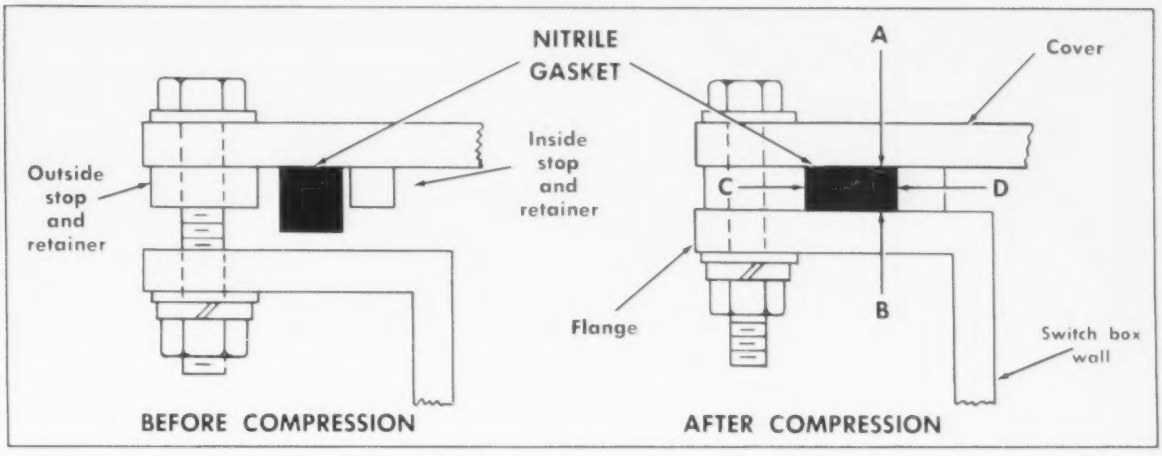
SEALING ARRANGEMENT on h-v terminal-chamber cover of a 500-kva vaultmaster transformer is pointed out by E. N. Decker, Jr., G-E network transformer design engineer.

NEW . . . Nitrile gaskets for network transformers

Nitrile gaskets now used on both high- and low-voltage ends

REUSABLE NITRILE GASKETS provide tight, lasting seal and do not require cementing, simplifying routine maintenance.

LOW-VOLTAGE THROAT has a milled groove that acts as a retainer and stop to assure proper gasket compression.



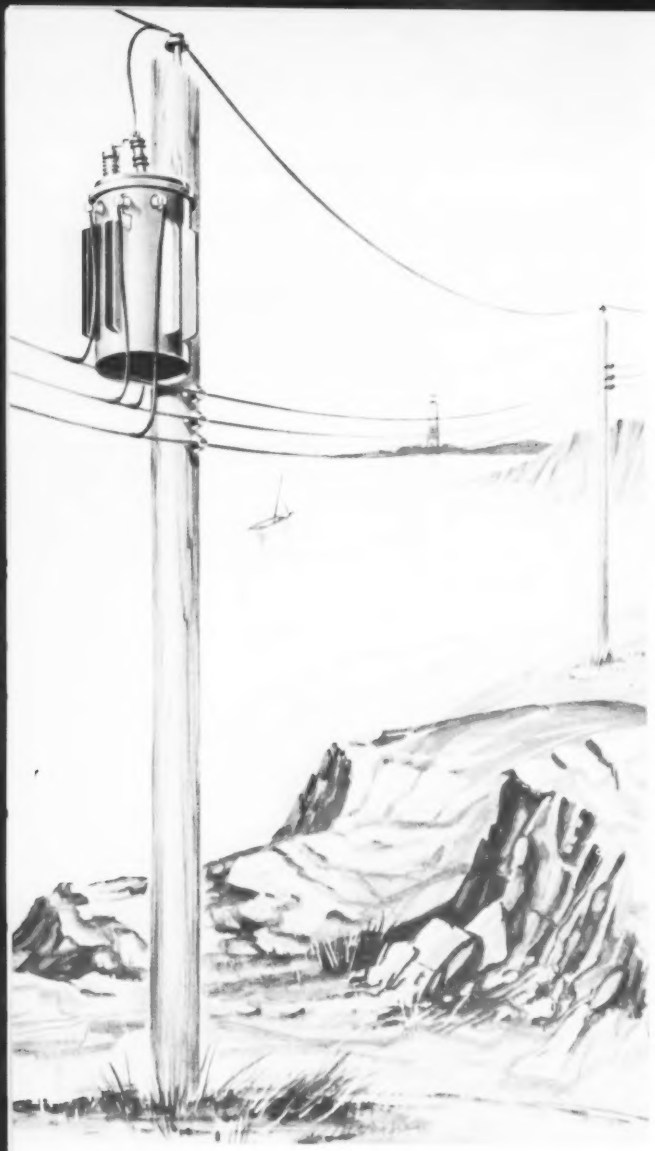
HIGHLY EFFECTIVE SEALING of h-v compartments on General Electric network transformers is provided by this special gasket and retainer arrangement. When covers are bolted tight, proper size and spacing of stops and retainers assure constant, pre-determined back pressure of Nitrile rubber gasket against surfaces A, B, C, and D.

Nitrile rubber gaskets are now used on both the high- and low-voltage ends of General Electric network transformers. Nitrile gaskets provide a tight, long-lasting seal. These gaskets, when properly "contained" and "stopped" are superior to other gaskets in sealing ability. Since they do not take a permanent set like cork or cork-rubber gaskets, they can be used repeatedly. Cement or other adhesives are not required. And, Nitrile rubber gaskets last longer because they do not deteriorate with age in this self-sealing design.

A special groove, milled into the low-voltage throat, and special "stops" on the h-v switch cover and terminal-chamber cover firmly hold the gaskets in place.

Savings in installation costs and maintenance, as well as reliability against leaks, are assured with this sealing arrangement.

GENERAL ELECTRIC



NEW Corrosion-resistant transformer finish for seacoast areas

General Electric now offers a distribution transformer with a special finish for highly corrosive atmospheres. These special units for seacoasts, chemical plants and other corrosive areas are available in standard pole-type ratings through 167 kva.

To combat tank corrosion, a Melalast* finish is applied to the entire exterior of the transformer. This effectively seals the metal finish and prevents corrosion. Even in the event that this Melalast finish is chipped — highly unlikely with this tough new coating — the exposed pinpoint area will not spread, and there will be no underfilm creepage which is so damaging to painted metal.

* Trademark of General Electric Company

Current General Electric bulletins you can use

Distribution Equipment for Residential Underground Systems — GEA-6981

10 Reasons Why General Electric Is Your Best Transformer Buy — GEA-6070

Self-protected Distribution Transformers — GEA-6126

Vaultmaster Network Transformers — GEA-5024

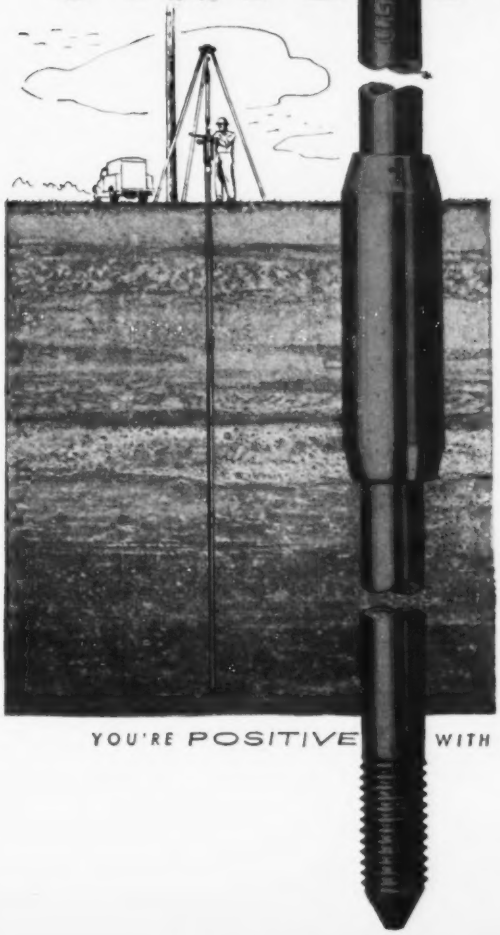
For complete details on these important advances in distribution transformers, contact your General Electric Sales Engineer. For copies of these bulletins, write to Sect. 431-88, General Electric Company, Schenectady 5, N. Y.

Progress Is Our Most Important Product

GENERAL ELECTRIC

DRIVE DEEP WITH Copperweld®

sectional ground rods

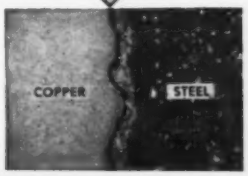


Don't jeopardize your overhead line performance by skimping on ground rods. You can achieve reliable, low-resistance ground connections by driving Copperweld Sectional Ground Rods deep into the earth's sub-surface where there are good conducting soils. And by measuring resistance after each sectional rod is driven—allowing for seasonal variation—you can make sure of permanent grounding protection.

Drive deep with Copperweld! You'll improve line performance, promote safety, avoid damage, and assure uninterrupted service.

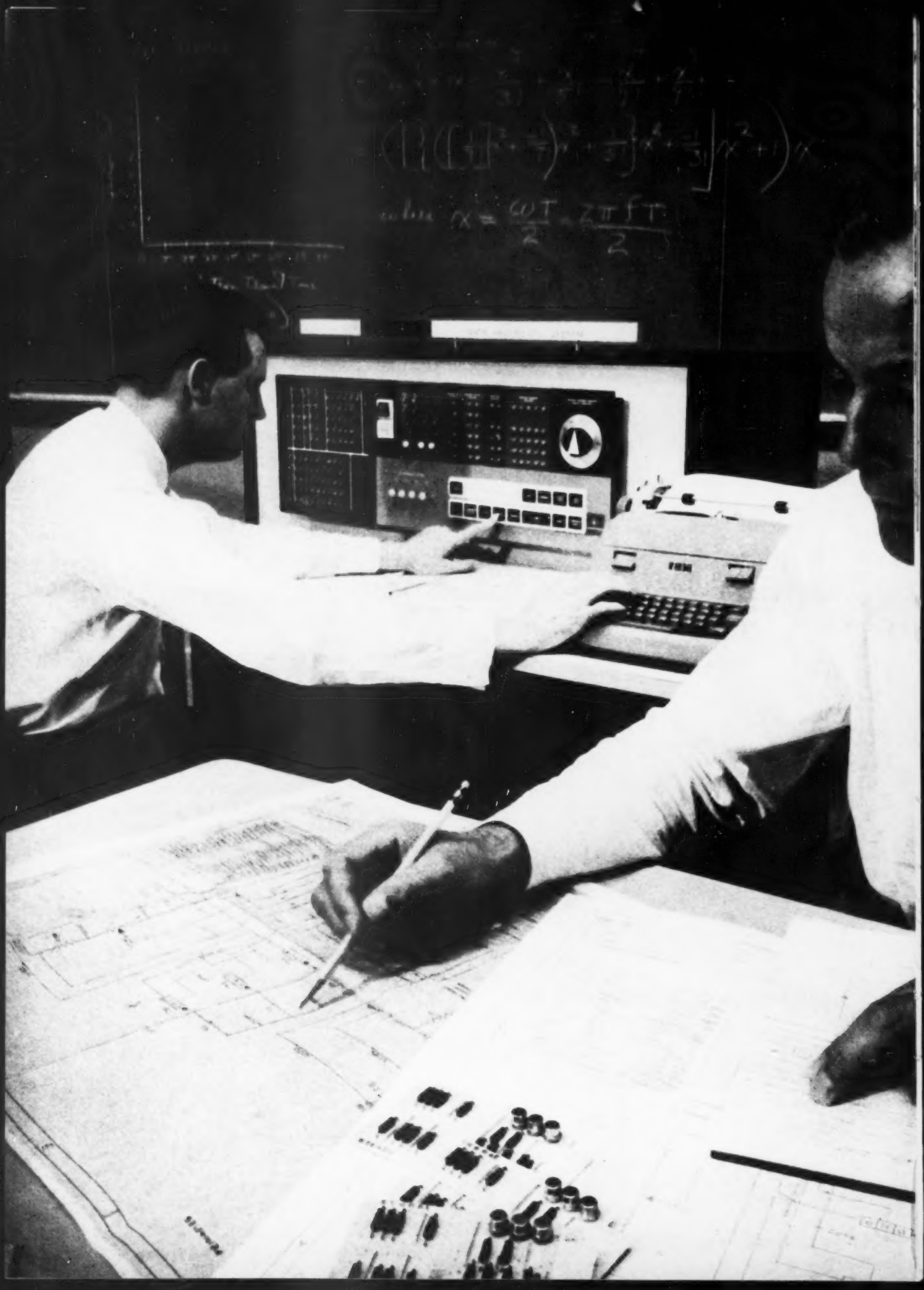
COPPERWELD STEEL COMPANY
WIRE AND CABLE DIVISION *Glassport, Pa.*
For Export: COPPERWELD STEEL INTERNATIONAL COMPANY, New York

YOU'RE POSITIVE WITH THE MOLTEN-WELD



This microphotograph of the weld area of Copperweld Ground Rods shows how the grains of copper and steel alloy to form a permanent, continuous weld. No other process achieves this inseparable union.

For phone number of closest representative see advertising index in back of book.



announcing the new

IBM 1620

first solid state engineering computer in the low-price field

Here is a new and powerful stored program, desk-size computer designed to bring more computing ability to engineering problems at low cost.

Transistorized throughout, the IBM 1620 is the only solid state, core-storage computer in its price class.

Easy to learn—easy to operate—easy to communicate with—this powerful computer relieves engineers from routine calculations—frees them for creative tasks.

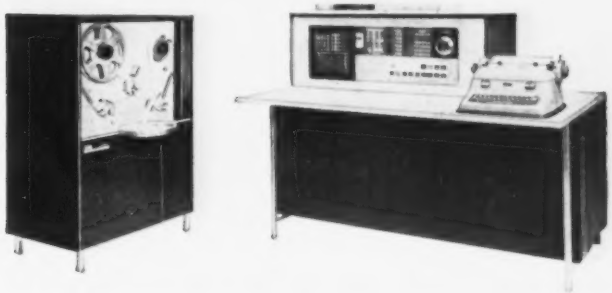
Data is fed into the 20,000-digit magnetic core memory of the 1620 via punched paper tape. Alpha-numeric output is printed at the console typewriter in desired format, under stored program control.

This new computer with its two-address instruction format and variable field length, gives you up to 50% more storage capacity than a fixed word-length system.

All notations of input and output are in the decimal system. An unlimited decimal field and internal self-checking assure accuracy. A powerful two-address instruction format adds to the 1620's timesaving capabilities.

Programming is simplified through the use of IBM Fortran—a mathematical programming system which compiles machine instructions from algebraic and English language notation. A library of programs for standard engineering computations will also be part of the 1620 package.

Call your IBM representative—ask him to show you all the unique features of the IBM 1620. Like all IBM data processing equipment, this system may be purchased or leased.



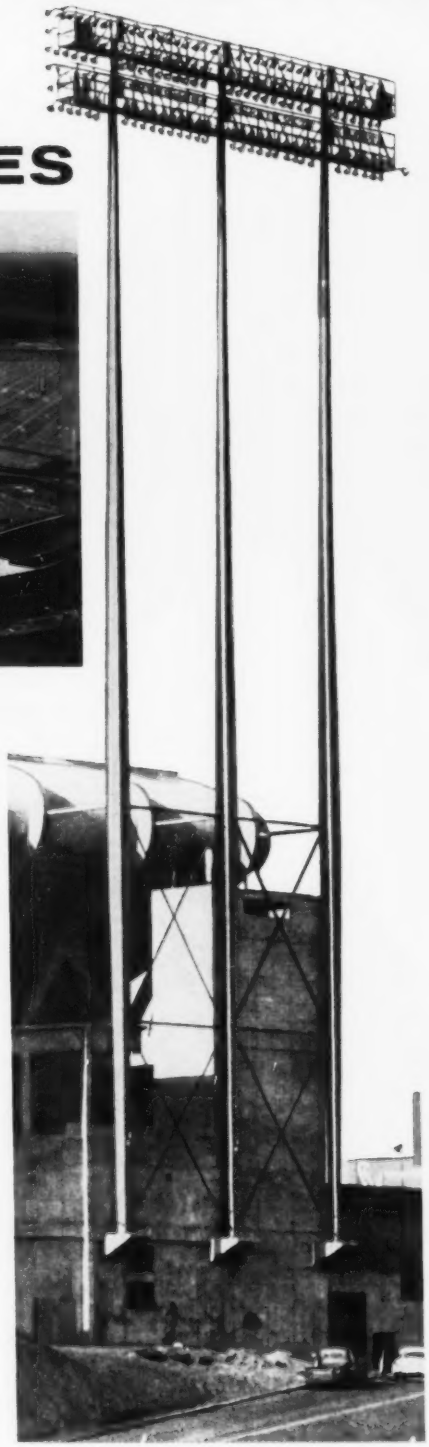
BALANCED DATA PROCESSING

IBM

Balanced Data Processing combines systems and services inseparably to produce performance in the best tradition of more than 45 years of IBM experience. It means more production per data processing dollar for you.

To floodlight Giants' Stadium,
WELD-RITE *builds the world's*

TALLEST LIGHT POLES



When the San Francisco Giants take the field for night games at Candlestick Point Stadium, they'll play under floodlights from ten 195 ft. and twelve 130 to 155 ft. high poles, specially fabricated by Weld-Rite. These are believed to be the world's tallest poles for floodlighting.

Twenty-six other Weld-Rite poles, 30 to 60 ft. high, will provide light bright-as-day in parking areas.

Like the Giants, you, too, will find it pays to light up with Weld-Rite. No matter what your lighting need—whether it be 10 ft. poles for traffic lights, or towering giants for floodlighting—call on us for help.

All Weld-Rite poles meet, or exceed, EEI-NEMA specifications. And, thanks to manufacturing in the West you can have deliveries to fit even tight job schedules.

For counsel on type of lighting system, lighting source, spacing, costs, etc., call or write our nearest office. Fully illustrated catalog also available. No obligation.

Note placement of Weld-Rite floodlight standards, behind spectators' seats, at Candlestick Point Stadium, so playing field and view is unobstructed.

WR CO.

WELD-RITE COMPANY
Only active manufacturer of round tapered steel poles in the West

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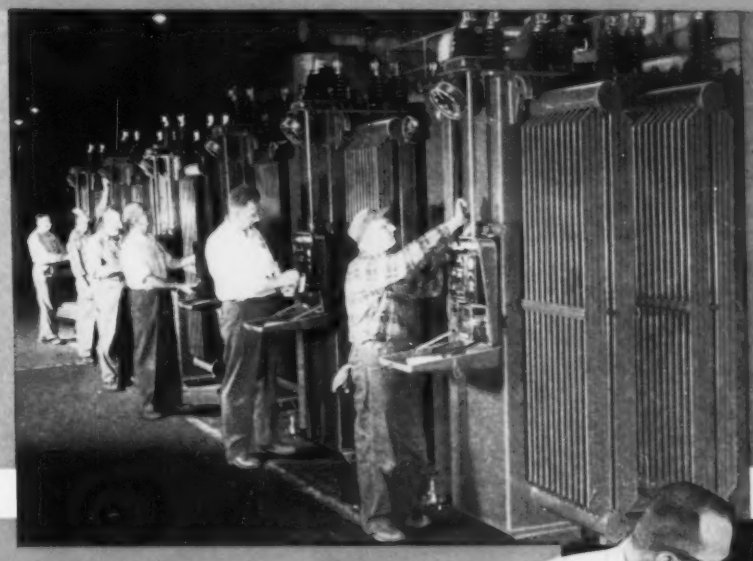
7

ALLIS-CHALMERS... Pacing Power Progress



Parts simplification and mass production methods.

highest quality regulators at lowest cost to you

Allis-Chalmers three-phase regulators

PACK MORE VALUE

Fewer and cleaner designed components in A-C three-phase regulators drastically cut machining and handling time — speed mass assembly manufacturing. Result: *true* low-cost regulation — yet all these advantages nowhere else available *regardless of price*. 33% less space required, 20% less weight for easy handling, lower installing cost. 30% less cost per kva of three-phase regulation and 160% *Vari-Amp* ratings offered to 600 amp maximum.

Regulator facts fast! Call, wire or write...

ALLIS-CHALMERS

Originators of 5/8% Step Regulators

A-1206-E

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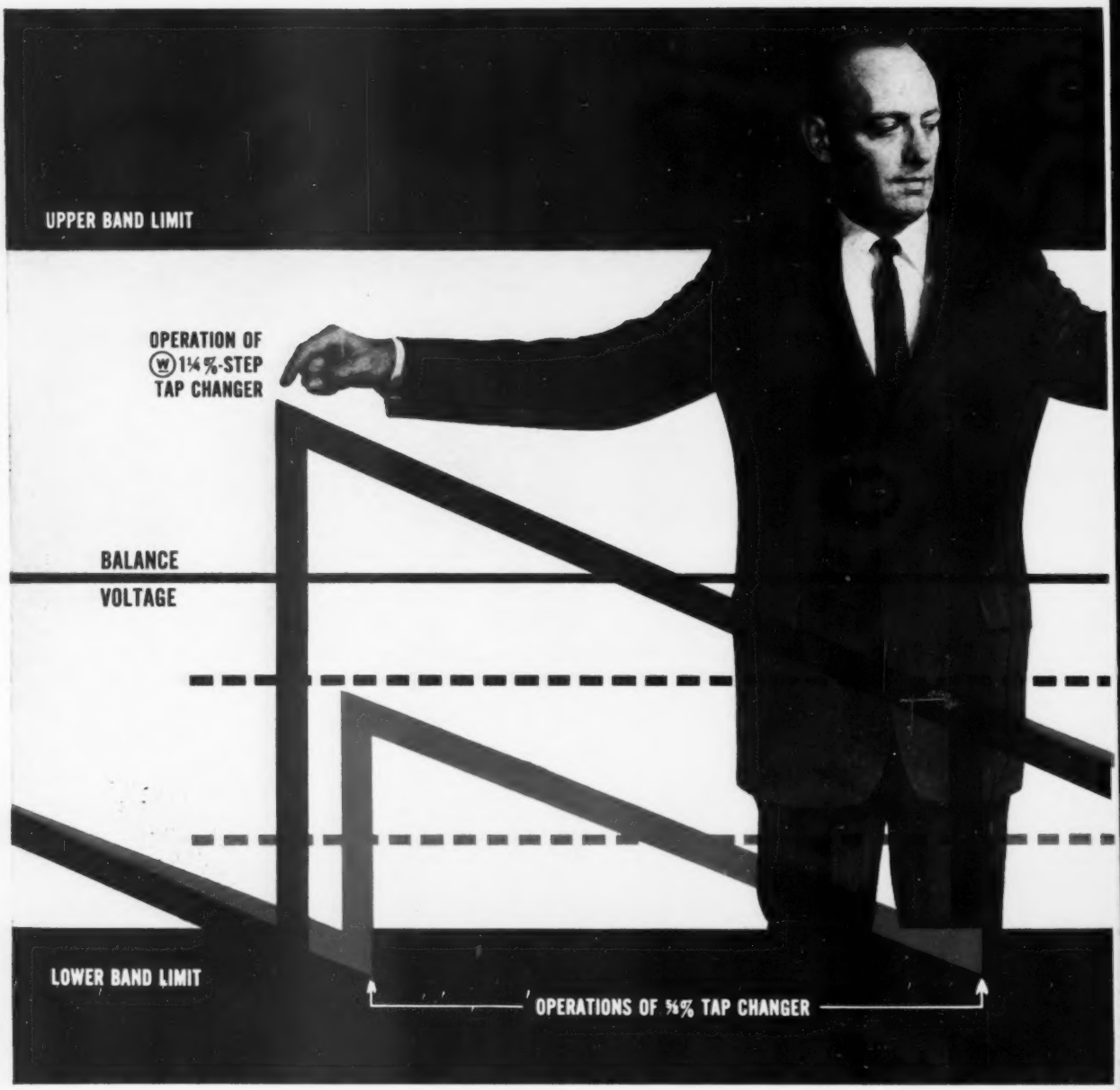
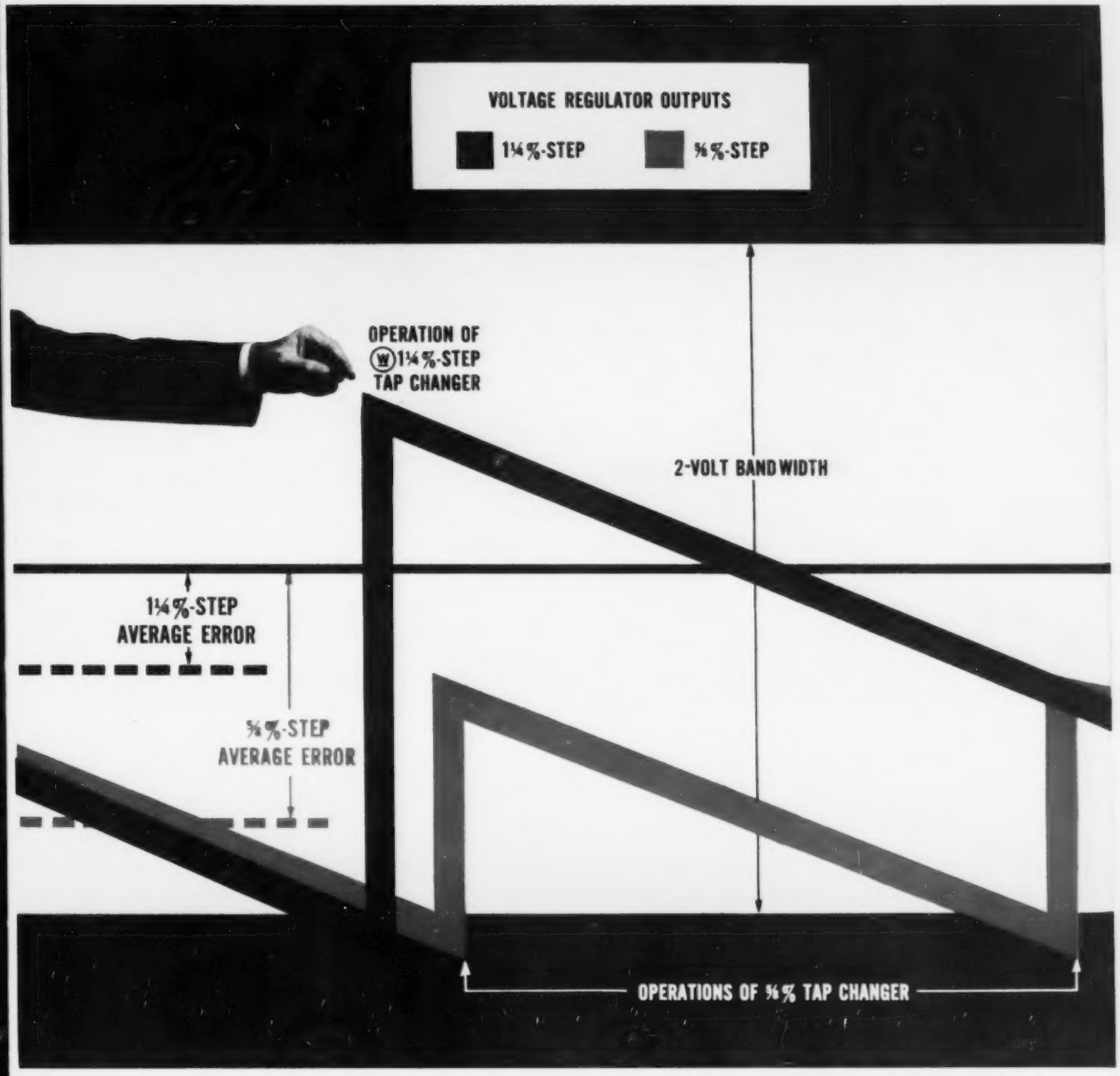


Here's how Westinghouse 1¼%-step regulation provides

Tap changer operations are the key to good system voltage control since no regulating is done until the tap changer operates. For best results, tap changes should be correctly timed and reasonable in number.

With ordinary control schemes, voltage relay bandwidths are often set in such a manner that it becomes necessary to effectively widen the band by adding fixed time delay to prevent an unreasonable number of tap changer operations. Where this is done, regulator output voltage bandwidth may vary widely, depending on the rate and extent of variation of input voltage. But with Westinghouse URL and URF regulators, you set the bandwidth you want and the unique CVR inverse time voltage relay, combined with instant response tap changer, prevents sustained wide voltage variations which are possible with fixed time delay. The result . . . a narrower effective band in the actual output where it counts. As an added benefit, the larger step gives an average voltage closer to midband, as shown in the illustration above.

You can protect your customers against abrupt voltage changes, get narrower effective bandwidths, and achieve better average levels when you use



closer voltage control . . . with fewer operations

Westinghouse 1¼%-step regulators; and you get longer life with reduced maintenance because fewer operations are required.

Ask your Westinghouse sales engineer for further details about the bonus values from Westinghouse 1¼%-step voltage regulators. J-70902

YOU CAN BE SURE...IF IT'S

Westinghouse

WATCH WESTINGHOUSE LUCILLE BALL DESI ARNAZ SHOWS CBS TV FRIDAYS

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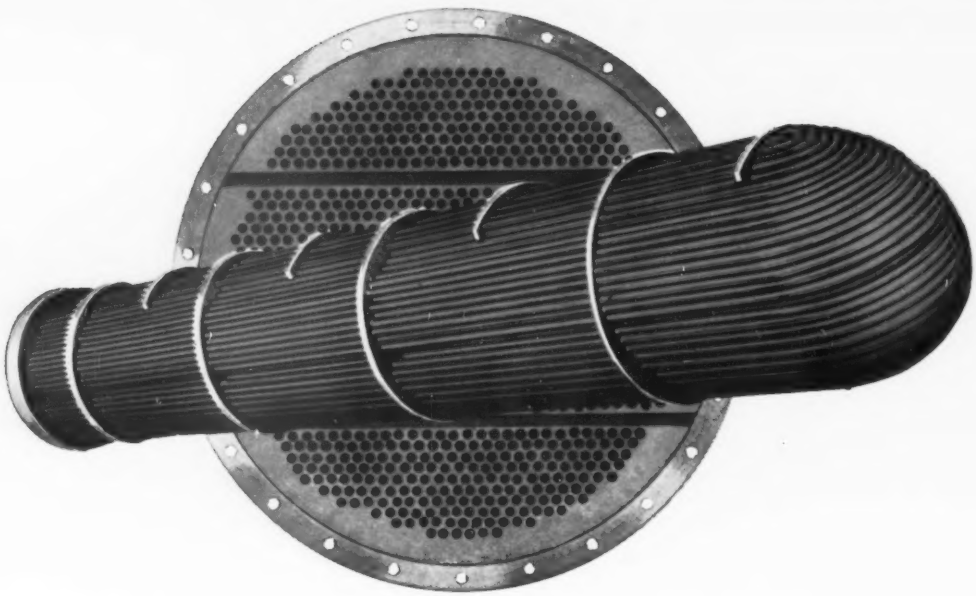
Specify

DUAL-GAUGE



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To keep tubes uniformly strong
in condensers, feed water heaters,
heat exchangers and similar equipment . . .

PHELPS DODGE

TUBING!

Provides heavier wall thickness:

a. At one or more points in tube length to compensate for thinning on outer portions of return bends.

b. At points of support.

c. At tube ends to meet special requirements.

Produced in all standard sizes or manufactured to the particular design requirements of individual customers.

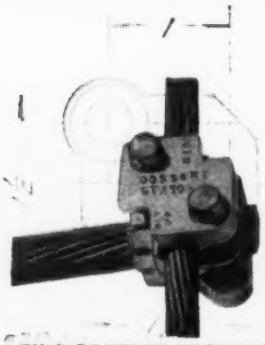
Available in Cupro-Nickel, Red Brass, Aluminum Brass, Admiralty metal and Muntz metal.

PHELPS DODGE COPPER PRODUCTS CORPORATION

SALES OFFICES: Atlanta, Birmingham, Ala., Cambridge, Mass., Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Fort Wayne, Greensboro, N. C., Houston, Indianapolis, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Washington, D. C.

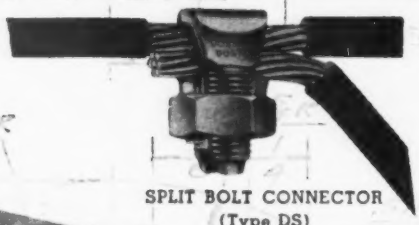
DOSSERT DESIGNED

with YOU in mind!

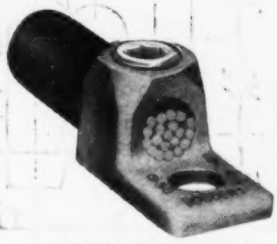


TWO POSITION VARIABLE TAP
(Type GTX)
For cross, parallel and tee tap connections.

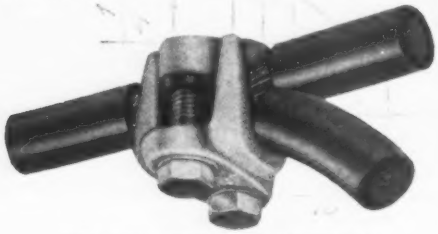
LIGHT DUTY VARIABLE LUG
(Type G)
For economical, all-purpose cable connections.



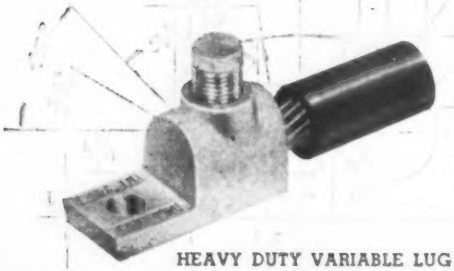
SPLIT BOLT CONNECTOR
(Type DS)
For taps, dead-ends, entrances, motor leads, junction boxes, etc.



VARIABLE TERMINAL
(Type D)
Connects a wide range of copper conductors to flat bar.



TWO BOLT SERVICE CONNECTOR
(Type DSU)
For all service cable connections.
Best for larger sizes.



HEAVY DUTY VARIABLE LUG
(Type HL)
Takes various conductor sizes.
Quickly installed.

For YOU, the contractor...
For YOU, the wholesaler...

The products shown here are in constant demand by contractors and are fast moving stock items. All items accept a wide range of cables, thereby, minimizing the number of stock sizes. They are packaged in convenient quantities for ease of handling and are attractively labeled for quick identification.

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DOSSERT MFG. CORP.
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Representatives in principal cities.

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INTERNATIONAL GENERAL ELECTRIC COMPANY
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150 East 42nd Street
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this is *modern* industrial *lighting*

Another easy-to-see improvement in plant lighting

Ask the people at Marchant Calculators Inc. about industrial lighting and they'll tell you, "Adequate lighting doesn't cost – it pays!" This modern *general* lighting in Marchant's fine Oakland plant makes *individual* lighting at work benches unnecessary. It's designed to direct 10% of the light upward to the ceiling and thus reduce shadows and glare that cause eye strain and human error.

It's a matter of record that the soft, even light produced by modern fixtures creates a better seeing environment and improves both the quality and quantity of work. This is the kind of modern plant lighting you'll learn more about by sending for the free booklet offered below.

Northern California Electrical Bureau

This message sponsored by

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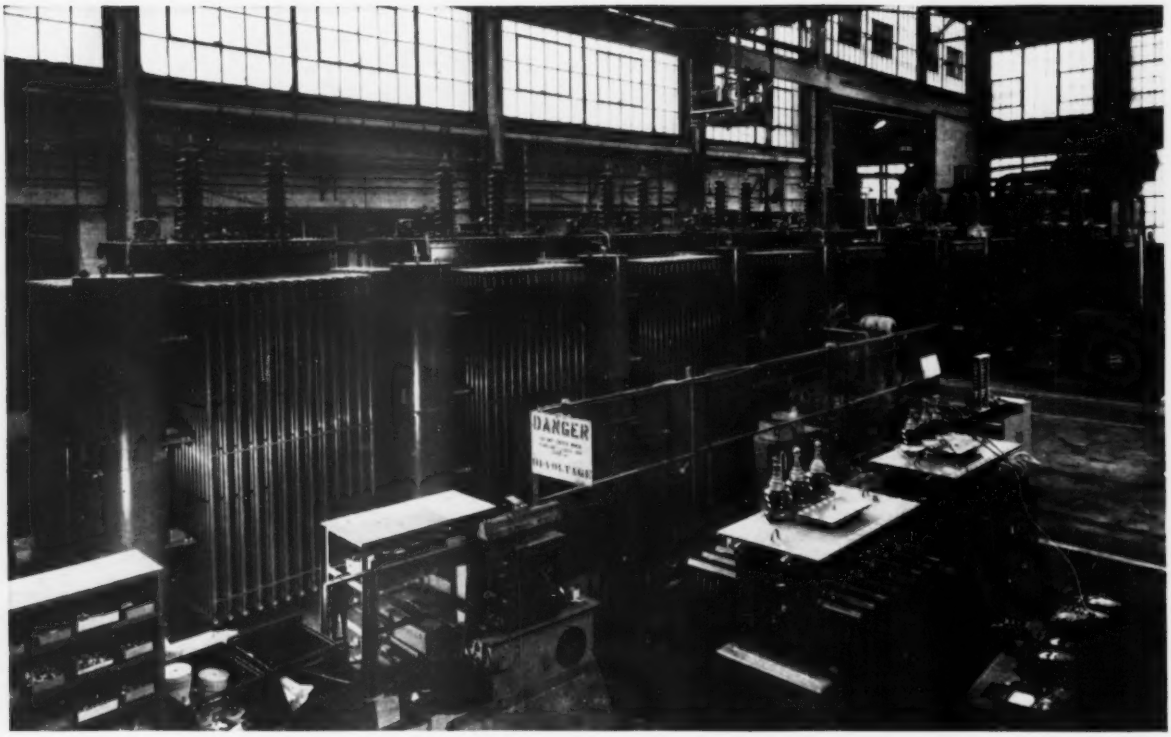

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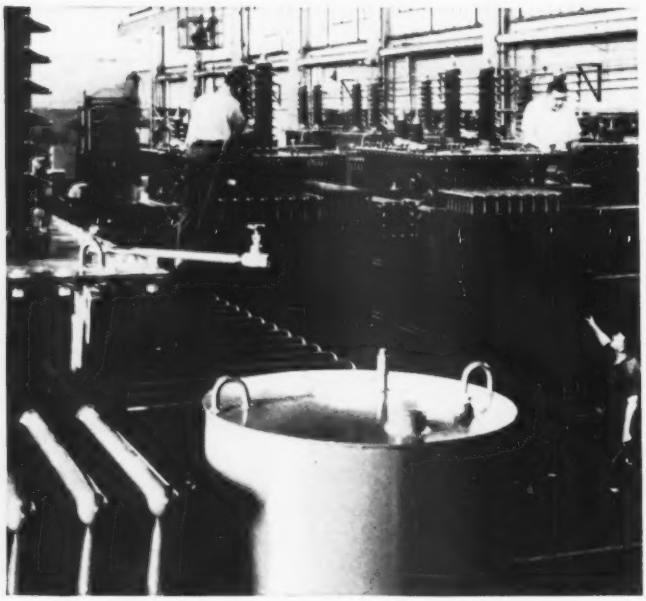

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LETTERS TO THE EDITOR

Failed to Mention

To the Editor:

This is a nice picture of the Peach Bottom plant (EWest, Oct. p 8), but somehow in spite of all of the publicity there has been it fails to mention the fact that we are the prime contractor for the over-all plant to Philadelphia with General Atomics being the nuclear steam system suppliers to us, and also performing the research directly for the AEC.

You might have someone note this in case there is occasion to speak of this plant again at some later date.

J. P. Yates
Bechtel Corp.

Impact of MV

To the Editor:

Observation of the phenomenon sketched below impelled me to imagine the idea might possibly be incorporated into one of your "Electra's Husband" editorials.

When we hung the mercury vapors, we turned out the other lights.

That is exactly what seemed to happen when the operation was performed. It is my lot to sit where we process applications from the citizens for the installation of additional street lights. A certain number of such requests is normal and inevitable.

But something special happens when the big mercury lights are hung on the arterial streets. The people who reside nearby, but not actually on the arterials, often immediately become aware that their existing side street lighting, hitherto quite satisfactory, has suddenly become feeble and ineffectual. Result: a sudden flood of pleas for more side street lighting. It is the newly created contrast between the big new lights and the old standard street lighting that does the trick. All at once they feel blacked out.

A major significance to a utility from the above seems to lie in its application to promoting commercial store lighting. In many commercial establishments it is often difficult to arouse interest in raising their lighting levels because of conjectural benefits and because the full impact of real lighting is hard to visualize.

Some kind of shock approach such as the mercury lights seem to effect might put the idea over. In areas where lighting level improvement seems to call for major effort, a utility might well study the advisability of making special inducements to get certain key or pilot locations to relight. The effect on the surrounding locations might easily be—er—electrifying? The reaction from the dimmed out neighbors to the mercury vapor lights indicates that it might do the trick.

E. G. Poo'e
Commercial Consultant
Seattle City Light

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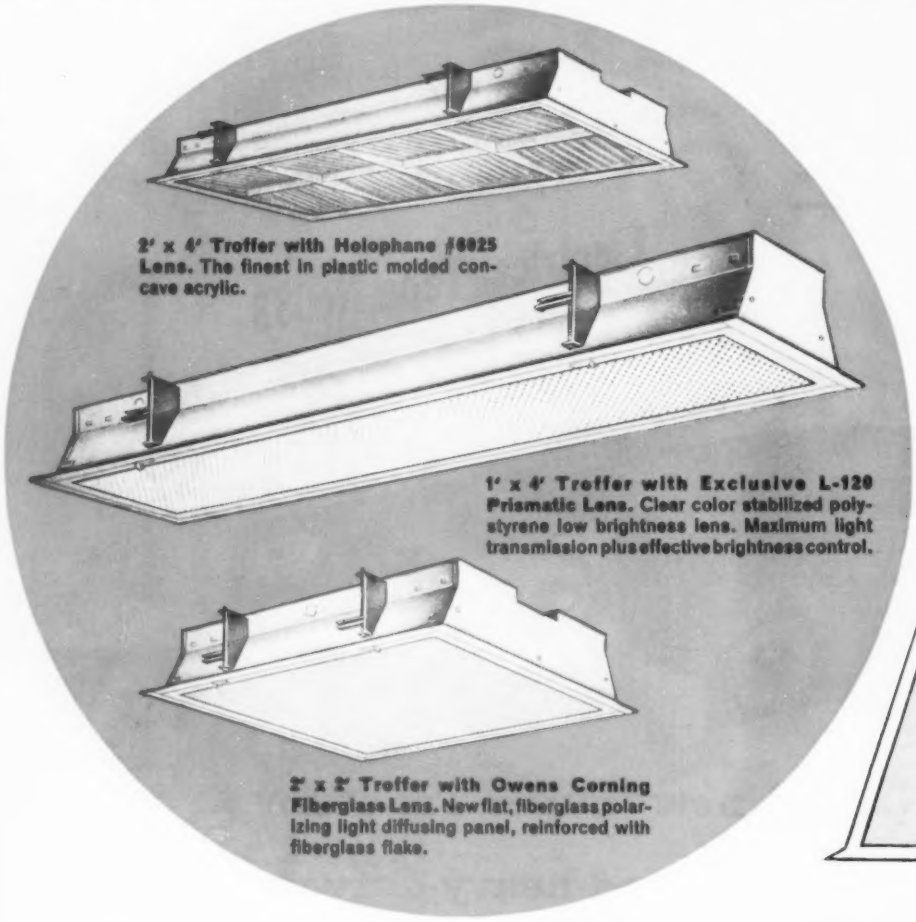
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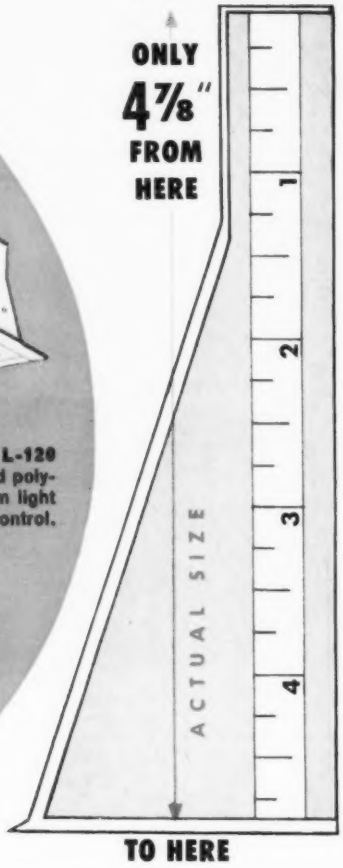

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ELECTRICAL WEST SPOKESMAN FOR MOST HIGHLY ELECTRIFIED REGION OF THE U. S VOL. 123 NO. 7 DECEMBER 1959

Five investor-owned utilities* plan long-range $130,000,000 transmission program to (1) fully integrate the power supply sources of the Intermountain area, both private and public, and (2) wheel initial and ultimate power from federal projects to preference and other users economically and reliably. The report shows the shape of:

Tie-Lines to the Future

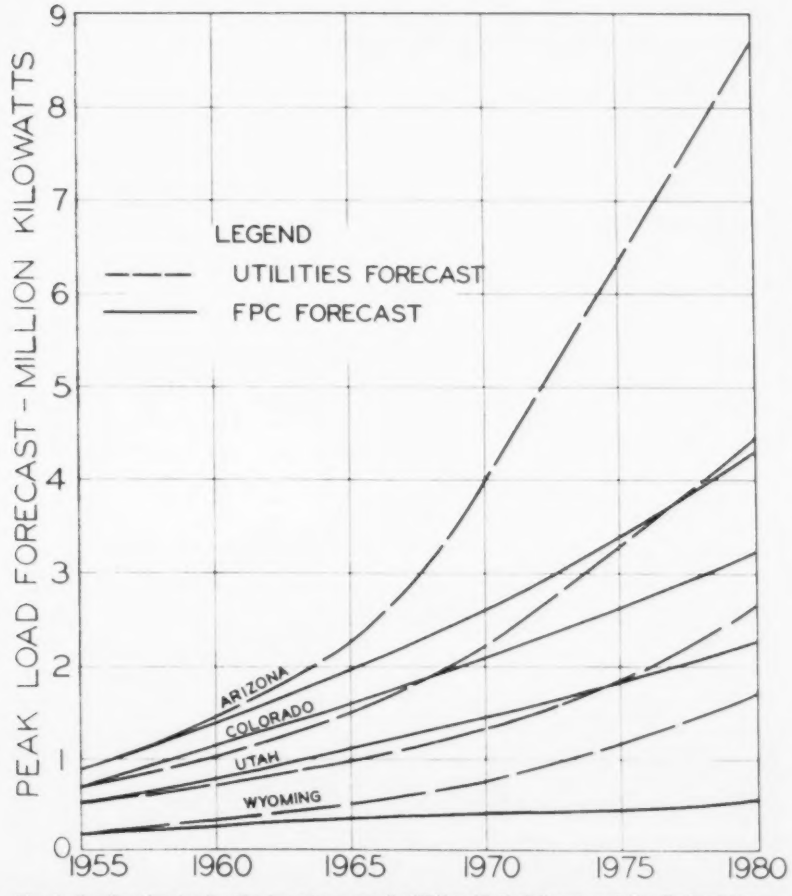


Fig. 1—Load estimates by the investor-owned utilities (dotted lines) and the Federal Power Commission (solid lines) by states through 1980. The cumulative loads in that year total nearly 20 million kw (see Fig. 4) and the projected generating capabilities of the region will total nearly 22 million kw. Only 1,100,000 kw of this amount will be installed by the federal agencies of the Colorado River Storage Project, leaving the remaining 95% as the responsibility of the major utilities of the region

Investor-owned power companies in the Intermountain area have laid long-range transmission plans that will meet their service obligations to the public through 1975. These plans contemplate the construction of 1,979 miles of transmission lines at a total cost of $88,850,000. This, together with proposed construction by the U. S. Bureau of Reclamation of 1,050 miles of line at a cost of more than $41,000,000, would provide the Intermountain area with facilities to utilize the 1,100 mw of

Table I — Growth Rates and . . .

STATE	Per Cent Rate of Growth 1960-65	1965-70	1970-80
Ariz.	10.6	10.0	8.3
Colo.	8.1	7.5	7.4
N. M.	10.3	10.1	10.1
Utah	6.8	7.4	7.3
Wyo.	10.4	10.1	8.1

. . . Peak Loads

	Peak Loads—Megawatts 1960	1965	1970	1980
Ariz.	1,478	2,445	3,946	8,768
Colo.	1,037	1,530	2,202	4,483
N. M.	254	415	671	1,766
Utah	751	1,046	1,495	3,016
Wyo.	338	554	897	1,955

*Arizona Public Service Co.; Public Service Co. of Colorado; Public Service Co. of New Mexico; Pacific Power & Light Co.; and Utah Power & Light Co. as reported in "Electric Utility Transmission Study as related to the Colorado River Storage Project."

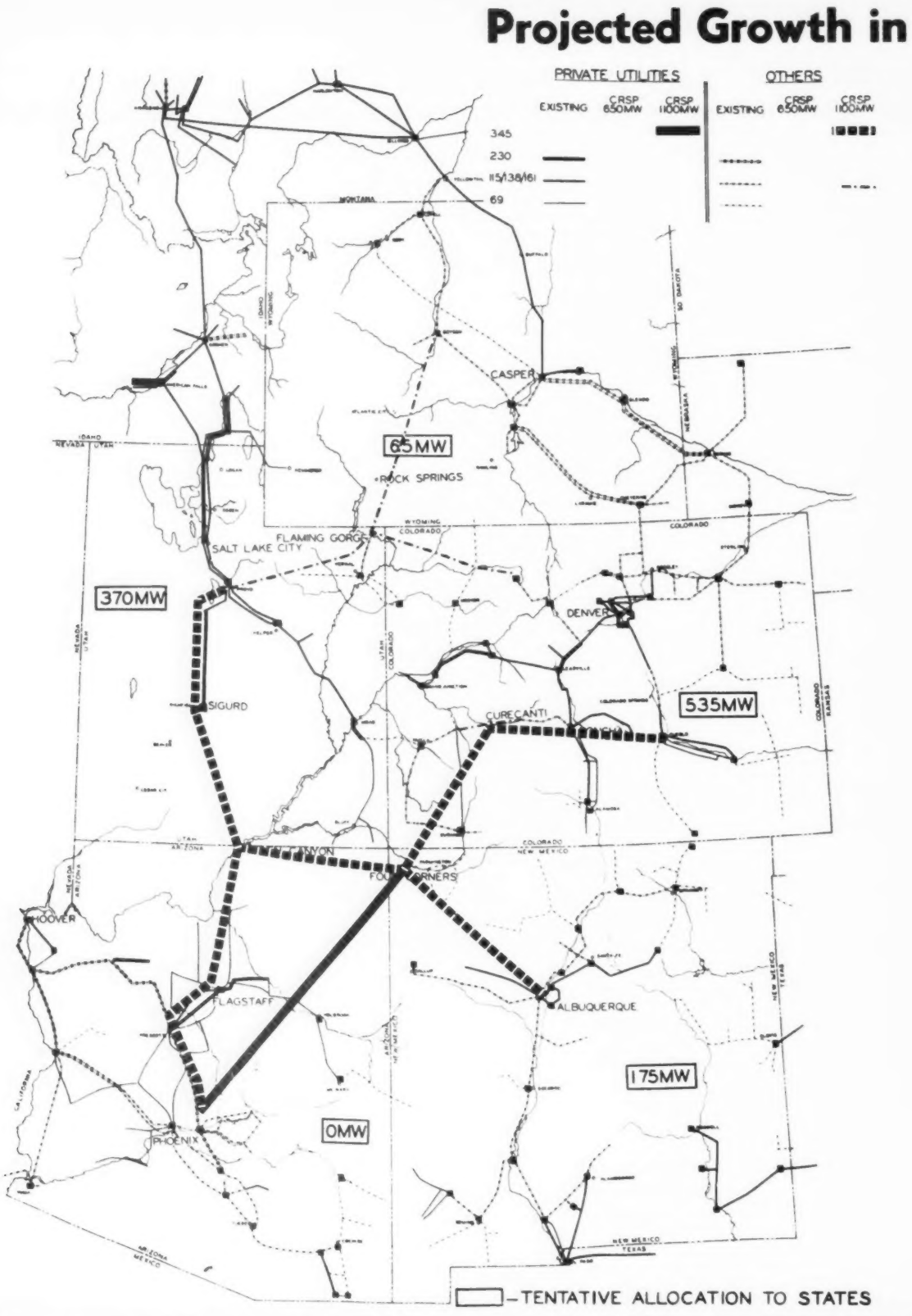


Fig. 2 — U. S. Bureau of Reclamation's tentative transmission proposal (dotted line) and tentative allocation of Colorado River Storage Project's 1,100,000 kw to states (indicated in squares). Other lines are existing, except Four Corners-Phoenix circuit

Transmission Facilities 1960-1980

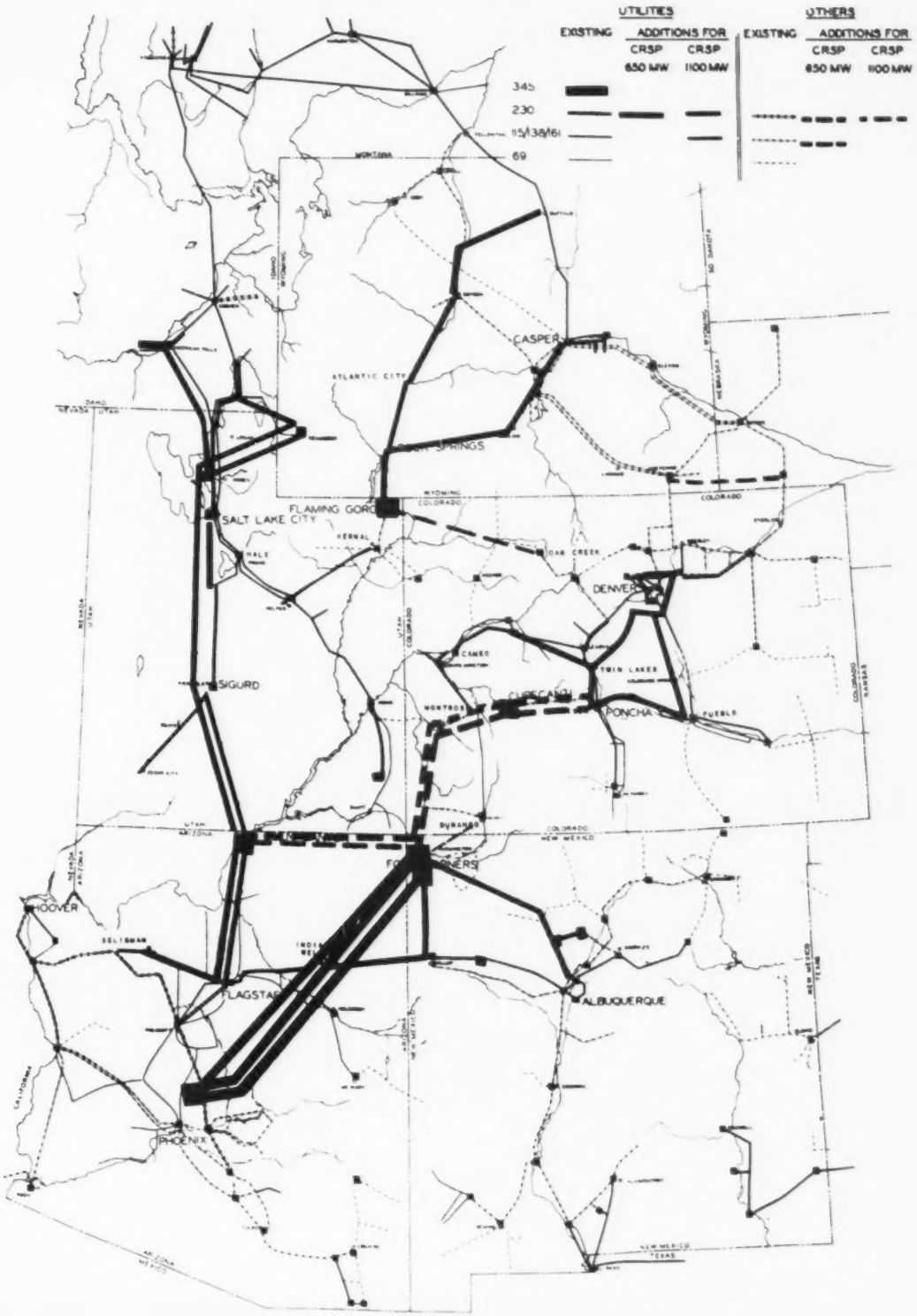


Fig. 3 — Intermountain transmission system as it will look 20 years hence, after the completion of the three stages of transmission construction outlined in Table 2 on p 62

Table II—Transmission Line Additions—1960-1980

Phase I—Additions Prior to Initial Operation of Colorado River Storage Project (by 1964)

LINE SECTION	Voltage Kv	Circuit Miles	Ownership	Miles
Salt Lake-Flagstaff (Ariz.)	230	130	APS Co	130
Salt Lake-Flagstaff (Utah)	230	295	UP&L Co.	
Carbon (Helper)-Vernal	138	93	UP&L Co	504
Sigurd-Cedar City	138	114	UP&LCo	
Four Corners-Durango	138	50	TWCP	50
Total				684

Phase II—Additions Required for Initial Operation of Project (1964 on)

Flagstaff-Seligman	230	60	APS Co	190
Glen Canyon-Flagstaff	230	130	APS Co	
Rock Springs-Casper	115/230	190	PP&L Co.	190
Four Corners-Albuquerque	230	180	PSCo NM	180
Flaming Gorge-Rock Springs	115/230	55	SWU	55
Glen Canyon-Four Corners (1st Line)	230	180	USBR	570
Four Corners-Poncha (1st Line)	230	240	USBR	
Flaming Gorge-Oak Creek	115	150	USBR	
Total				1,185

Phase III—Additions Required for Ultimate Operation of Project (by 1970)

Poncha-Twin Lakes-Denver	230	140	PSCo Colo	385
Poncha-Pueblo-Denver	230	180	PSCo Colo	
Cameo-Montrose	115	65	PSCo Colo	
Glen Canyon-Salt Lake	230	295	UP&L Co	295
Glen Canyon-Four Corners (2nd Line)	230	180	USBR	480
Four Corners-Poncha (2nd Line)	230	240	USBR	
Curecanti-Gunnison	115	30	USBR	
Curecanti-Montrose	115	30	USBR	
Total				1,160

Mileage Requirements by Ownership

Ownership	Circuit Miles
APS Co.	320
PP&L Co.	190
PSCo Colo	385
PSCo NM	180
UP&L Co	799
TWCP Co	50
SWU	55
Subtotal utilities	1,979
USBR	1,050
Total	3,029

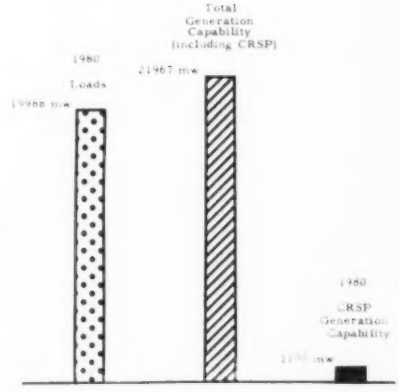


Fig. 4—(Right) Loads and generating capability of the region in 1980, together with capability of Colorado River federal power plants

power from the Colorado projects and the 16,000 mw to be supplied by private capital in the most economical manner possible.

Loads and Resources

The non-coincident peak loads of the five-state area are expected to increase from about 3,900 mw in 1960 to 20,000 mw in 1980, a total increase for this period of 16,100 mw. This increase is approximately 15 times the estimated total output of authorized Colorado project plants, indicating that the utilities will also install at least 16,000 mw of capacity during this period.

The estimated total peak loads by states are shown in Table I. The New Mexico loads are for the northwestern portion of the state. The Utah loads include the loads for that entire state plus the loads in the service areas of the Utah Power & Light Co. in southeastern Idaho and southwestern Wyoming. The Wyoming loads include loads of the extreme western portion of the State of Nebraska, loads of the interconnected systems in central Wyoming, plus loads in the Rock Springs area, excluding only loads in remote corners of the state not so interconnected.

Utilities' estimates of loads may be

Table III—Transmission Investment ($1,000's) 1960-1970

UTILITY PLAN	INVESTMENT Phase I	Phase II	Phase III	Total
Arizona	7,450	8,400		15,850
Colorado		1,000	18,000	19,800
New Mexico		8,200		8,200
Utah	22,000		14,600	36,600
Wyoming		8,400		8,400
Subtotal utilities	29,450	26,000	33,400	88,850
Bureau of Reclamation		20,950	20,600	41,550
Total	29,450	46,950	54,000	130,400
Per Cent of Total	23	36	41	100

compared with Federal Power Commission projections of loads by referring to Fig. 1. The utilities' estimates are generally higher than those of the FPC. (The comparison of load forecasts by the FPC and the utilities does not include New Mexico because the FPC area division is not compatible with the area of New Mexico dealt with in this report.)

The project generation capability as compared to the loads and total generating capability in the five-state area is shown by Fig. 4.

Calculations and forecasts indicate that the Upper Basin preference customers will require only 16% of the project capacity in 1965. By 1980 this percentage increases to 67%. In order for the project to achieve operating efficiency and meet the financial requirements of the authorizing legislation, the excess power from project plants must be marketed by the utilities for a number of years.

Transmission System

The final stage of the transmission system as proposed in this report will enable the transmission of project power in a manner compatible with tentative allocations by the bureau. (See Fig. 2.) In the initial stages, the proposed transmission system affords latitude as to disposition of power available.

The existing transmission lines are shown in Fig. 2. The proposed transmission additions are planned in three phases at the completion of which the area will be served as shown in Fig. 3.

Transmission Investment

The estimated investment required to build the system proposed by the utilities is shown in Table III. These figures contain only the investments directly related to the project and do not include the Four Corners-Phoenix lines.

The bureau's investment in this proposed transmission system occurs in connection with Phase II and Phase III. It amounts to 41% of the $100.95 million estimated for these two phases. Similarly, it amounts to 35% of the total estimated investments for all three phases.

An estimate for 345-kv lines and terminal substations, alternative to the principal 230-kv elements of the proposed system, indicates that these higher voltage features would cost 10-15% more than the 230-kv elements. Most of the investment for the 345-kv alternative would occur at time corresponding to Phase II of the proposed plan.

General Considerations

Regarding comparison of the use of two 230-kv circuits vs one 345-kv circuit for interconnections between main power systems, this problem is not unique to this situation. It is a problem that is arising today in system planning in many other parts of this country and abroad. It is similar to problems that have been solved in the past by the electric power industry in development of 115-kv, 138-kv, 161-kv, 230-kv and 287-kv systems.

In these respects the utilities approach this choice of voltage from the standpoint of providing general-purpose circuits, which sooner or later become elements of a comprehensive power transmission network serving all power loads of the area, rather than from the more limited standpoint of transmitting a specific amount of power between two fixed terminal locations. As an operating voltage, 345 kv has certain inherent advantages for long, heavily loaded circuits and for somewhat shorter distances when the power to be transmitted justifies two or more parallel 345-kv circuits. For the situation here under study, the amount of power to be transmitted over any one route and the distances involved without important tap-offs are deemed insufficient to warrant use of 345 kv for the principal outlet circuits from Glen Canyon station.

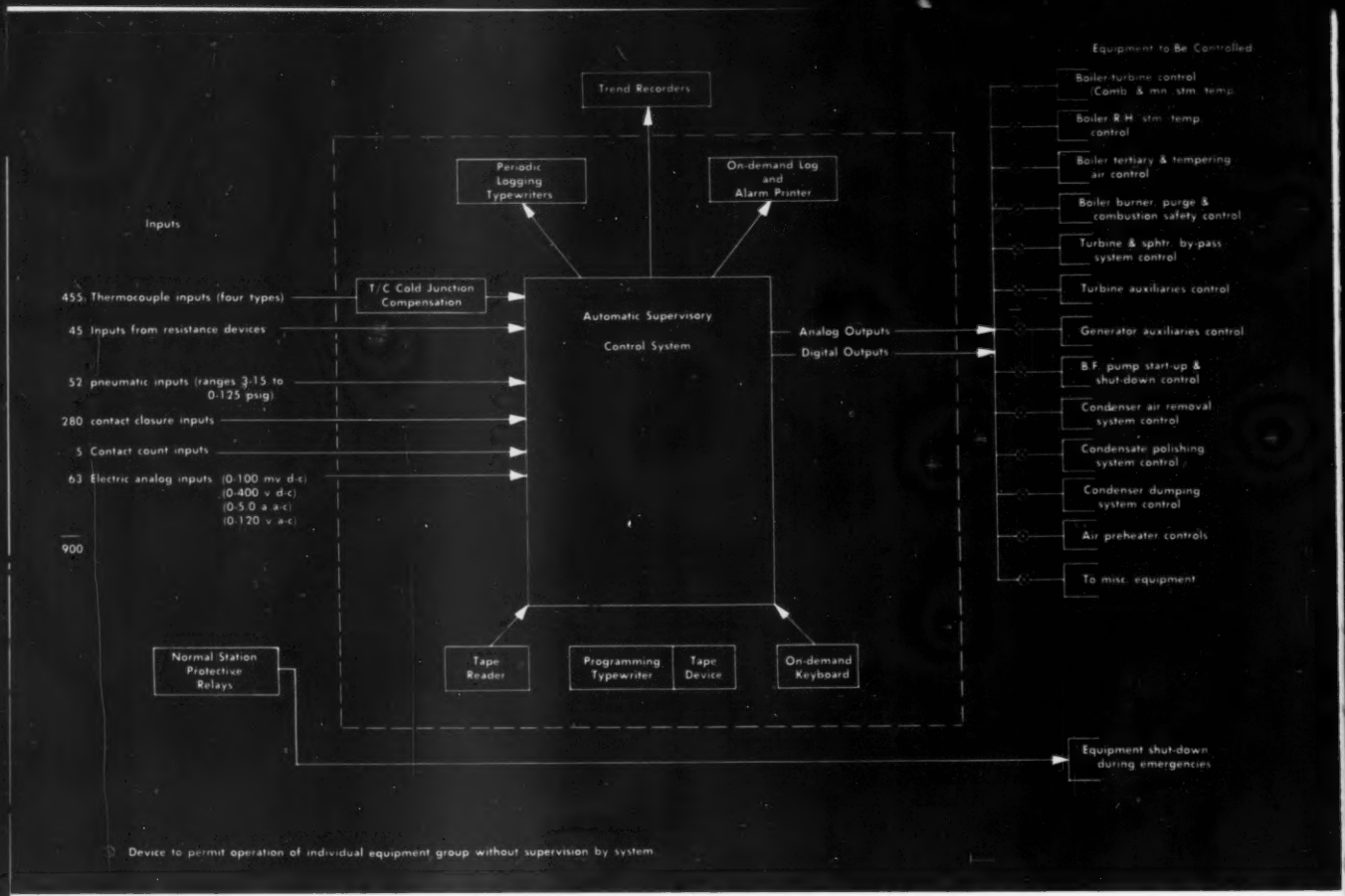
Considering the routes from Glen Canyon to Salt Lake, from Glen Canyon to Flagstaff, and from Four Corners to Poncha, a single 345-kv line on any of these would impose heavy and uneconomical requirements upon the systems in the receiving areas for reserve generating capacity as compared with the proposed pairs of 230-kv lines. The reserve generating capacities required to protect customers' service in cases of outage of individual 230-kv lines on these routes are compatible with the reserves carried in the respective receiving areas.

It is anticipated that each of these lines will be tapped at intermediate points as loads develop in areas along the routes. Tapping 345-kv circuits for intermediate loads is much more expensive than tapping 230-kv circuits. For each of the above routes two 230-kv lines are more stable under operating and fault conditions, and are also found to be less expensive to construct and terminate than single 345-kv lines.

In addition to the above benefits, 230-kv construction allows the transmission system to be planned and built in segments as loads develop and as added generation is installed at the power sites. This spreads the capital expenditures over periods consistent with the growth of revenues from the sale of power as the project develops and allows flexibility for changes and additions in planned routes and terminals as future loads develop.

The transmission system as developed herein will:

1. Interconnect the power systems of the Upper and Lower Basin areas, and integrate the operation of Colorado River Storage Project plants with other federal plants and utility systems in the areas.
2. Provide transmission line capacity to:
   (a) Transmit utility company power requirements.
   (b) Market project power.
   (c) Wheel project power to preference customers in accordance with the bureau's tentative allocations shown in Fig. 2.
3. Permit a substantial saving in capital and operating costs.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Equipment shut-down during emergencies
Device to permit operation of individual equipment group without supervision by system

The man behind Edison's courageous move to computerize the controls at Huntington Beach 3 and 4 says . . .

Utility Automation Isn't New!

W. L. Chadwick, Vice-president, Southern California Edison Co.

Automation is by no means new to the utility industry. It is as old as the first governor on a generating unit and certainly as old as the first relay used to interrupt a faulted circuit. Often laymen, teachers and utility men alike consider that the utility industry has lagged behind the growing procession of automation users.

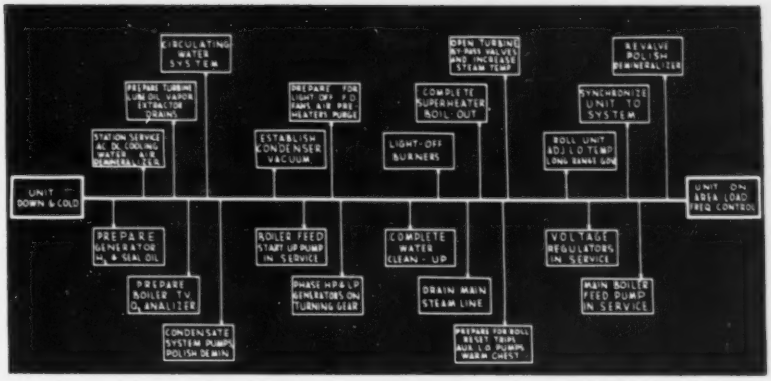
Nearly 40 years ago Southern California Edison Co. devised, perfected and applied automatic control of stream flow hydroelectric plants. The company was one of the first to use varying-characteristic relays to protect faulted circuits. Prior to this latter development, utility managers and customers alike were satisfied to have a substation operator alert himself to circuit trouble by an alarm, rise from his desk and log book, appraise the data shown by meters and gages, and open the circuit that he determined was in trouble or take whatever other action was indicated. Demands for improved system stability and for greater reliability of electric service changed all this dependence upon an operator and demanded much more prompt action. Ingenious diverse-characteristic relays were the answer—relays which now will interrupt a faulted circuit before a broken conductor can fall to the ground.

Later, for various reasons, systems were devised so that remote switching center operators could control six, eight or ten distribution substations as competently as if those operators could be present in each affected control room. Using these systems existing conditions at the remote station are revealed, actions are initiated and the results are reported as completely as if a human operator were on the site resolutely and competently performing his duties. For the Southern California Edison Co. this kind of automation came immediately after World War II.

Automatic Hydro Plants

About 10 years ago a new small hydro plant was designed by the same company for operatorless remote control. These controls were somewhat too elaborate for the importance of the task, but they performed satisfactorily enough to lend the courage and experience for the design and

Left, block diagram shows how computer must evaluate 900 input signals in order to initiate correct control signal for stations equipment and measure station performance. Right, diagram shows start-up sequence which computer will initiate and supervise until units are on the line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PREPARE GENERATOR H2 & SEAL OIL
BOILER FEED START UP PUMP IN SERVICE
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VOLTAGE REGULATORS IN SERVICE
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building of controls for a 10,000-kw hydro unit to be operated from another station 11 miles away. The controlled station was deep in the Sierra Nevada Mountains at a 7,000-ft elevation subject to heavy snows which endure for months. For three years now this station has proved highly reliable and has required only low maintenance.

Two years earlier a system was designed and built for remote operation of the water control works for a reservoir in the mountains at an elevation of nearly 8,000 ft using microwave signals. This system has now had five years of satisfactory service.

Experience with these works encouraged the design and the current construction of the remote control of a two-unit 150,000-kw, 1,100-ft-head hydro station which will be supervised and operated from several miles away, aided by closed-circuit television scanning of the control room and generator floor, and using microwave control and feedback signals.

With continuing emphasis by customers, regulatory groups and utilities, on greater and greater reliability and with the increasing amount of capital tied up in steam-electric generating units, plus this background of automation, it is not surprising that computer controls should now be applied to steam-electric generating plants. Certainly nowhere else on a utility system is more capital concentrated in one place with a greater need for continuous operation and service reliability. Accordingly, search for the best automatic devices for generating unit control is demanded.

Behind the Decision

Decision by Edison to build computer controls into the Huntington Beach No. 3 and No. 4 units was premised upon all the foregoing experience. Specifically, computer automation was considered imperative for the following reasons:

1. The combustion and rotating equipment involved is of such high value to the company's system that every reasonable device must be used to assure it against the consequence of misoperation.

2. Analysis of faults should be more competent in the detached atmosphere of a design room than under the hectic necessities of restoring service from a unit in trouble.

3. Scanning of data for alarming deviations can be accomplished many times faster and from many more points of observation by computer devices than by any human attendance.

4. The saving in lost capital costs alone for each day of avoided loss of availability of a large unit can exceed $10,000 per day. One hundred twenty days of lost operation saved by computer control during the operating life of a unit will more than pay for the whole computer control installation. All savings of power replacement costs are in addition.

5. It is confidently believed that for new installations important savings can be made in operating labor.

6. It is also believed that maintenance and repair costs can be lowered through earlier determination of faulty conditions and more prompt correction.

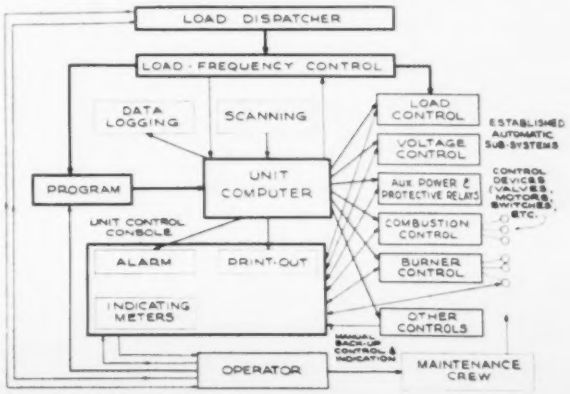
7. It is further believed that the more constant supervision of temperature changes, which is possible through computer control, will result in longer equipment life, lower maintenance costs and lower fuel costs.

Automation has become second nature in the nuclear reactor field. It is fast becoming so in pacing processes whether for a stream of materials in a chemical plant, a stream of petroleum in a refinery or a strip of steel through a mill.

Study Group Formed

With the utility industry's past record in the use of automatic devices, computer control is a natural application. Accordingly when Southern California Edison Co. first became interested in such an application it welcomed the suggestion of John Kiely of Bechtel Corp., during late 1957, that his company join, at its own cost, in a task force study of computer controls for steam power stations. This suggestion was quickly accepted and a joint study group was established. Excellent cooperation was enjoyed from equipment manufacturers. With more than a year of study by this group, representing designers, operators and manufacturers, it was possible to write a performance specification for a computer control system as the basis for inviting proposals. Selection of the system to be used for Huntington Beach units No. 3 and No. 4 followed after careful comparison of several proposals. The basic control sequences upon which the system is now being designed are shown on the accompanying charts.

Diagram shows how station control computer will be integrated with system load control



With an HTGR prototype abuilding, here are the reasons it holds . . .

New Promise

Tall cylinder is graphite-clad fuel element. The large size provides excellent heat transfer characteristics. Beside the complete fuel element is the inner fuel bearing graphite cylinder. Metal cylinder is sample metal-clad element which may be used for the initial core loading. Below, artist's sketch of the HTGR prototype presently being built by Bechtel Corp. for the High Temperature Reactor Development Assn.—composed of a group of 52 utilities. It will operate as a part of the Philadelphia Electric Co. system

Four short years ago General Dynamics was not engaged in central station nuclear power. The company wanted to engage in the civilian field of nuclear development, the basis of which rested upon the real needs of an expanding world population. The creation of a central station nuclear power system fitted most logically, of course, into such a program. The challenge was not nuclear power alone but economic nuclear power. Achieving this goal more quickly than current attempts appealed strongly to us.

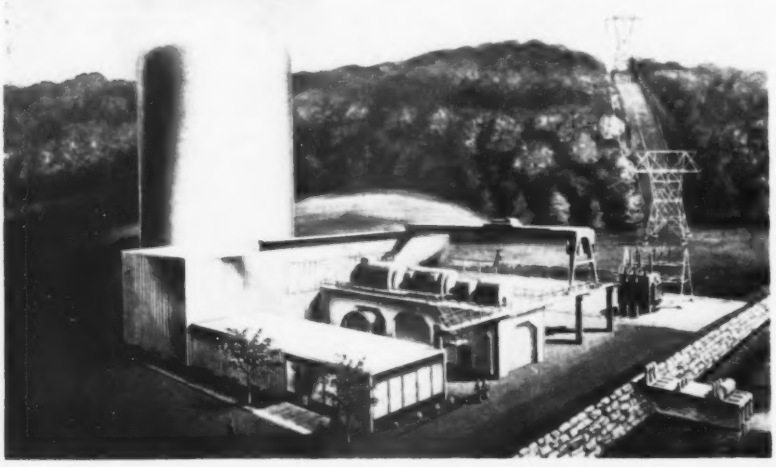
To get an economical system, in a field as complex as this, required very basic scientific and engineering programs, rather than a purely manufacturing approach.

What general premises could be used as criteria for selecting an avenue of investigation with high promise of achieving low-cost nuclear power? Here are a few.

- If atomic energy is one day to succeed in free competition with other electric power sources, nuclear power development must turn away from indulgence in various luxuries and compromises, such as low working temperatures and the wide-spread use of exotic materials and highly expensive techniques. Development must be directed toward high working temperatures and the maximum utilization of relatively inexpensive materials and techniques.
- The solution to metallurgical and heat transfer problems could not include the use of materials and coolants having excessive neutron absorption characteristics. This is because high fuel utilization with a minimum dependence upon reprocessing lies at the heart of reducing power costs.
- Something less expensive than the complicated "Swiss watch" type of fuel elements is indicated.
- A nuclear power system, if it is to have sound economic promise, must be technologically simple and compact as a means of reducing capital costs.
- The system should be capable, above all, of producing steam at modern steam-turbine conditions so that the use of the nuclear reactor as a heat source will not turn back the clock of technological progress when it is coupled to a utility plant's turbine-generator.
- It must have high thermal efficiency, without compromising low capital costs, thereby contributing to low operating costs.
- It must be capable of long life of the nuclear fuel elements so as to hold to a minimum the handling of radioactive substances and to further reduce operating costs.
- Above all, the system must possess a high degree of inherent safety.

It was with these objectives in mind that General Dynamics decided, in early summer of 1957, that high-temperature, gas-cooling offered the greatest promise of achieving these goals essential for economic power.

Since then, theoretical and experimental work and design development has been carried on at the General Atomic Division with over $2 million of private funds—including support received from the Rocky Mountain-Pacific Group and San Diego Gas & Electric.



Power Up 20 Times

Critics of gas-cooled reactors point out that because of the poor heat transfer and carrying properties of gas, it is necessary to construct large, and consequently expensive reactor

for Economic Nuclear Power

C. A. Rolander, Vice-president, General Atomics Division, General Dynamics Corp.

vessels and heat exchangers. The British Calder Hall reactor is illustrative of this problem. The Calder Hall reactor uses natural uranium which is readily available to the British. It meets the electrical generating demands of Great Britain where the cost of conventional fuels is high, but it does not appear to offer the promise of economic power in the U. S.

The recent advancements in technology and the use of enriched uranium combine to overcome this problem. Gas-cooling now offers tremendous opportunities to develop economic nuclear power for the U. S. For example, the HTGR concept permits the pressure vessel power density (based on electrical output) *to be increased about twenty-fold*, as compared with natural uranium gas-cooled reactors.

The Peach Bottom Plant

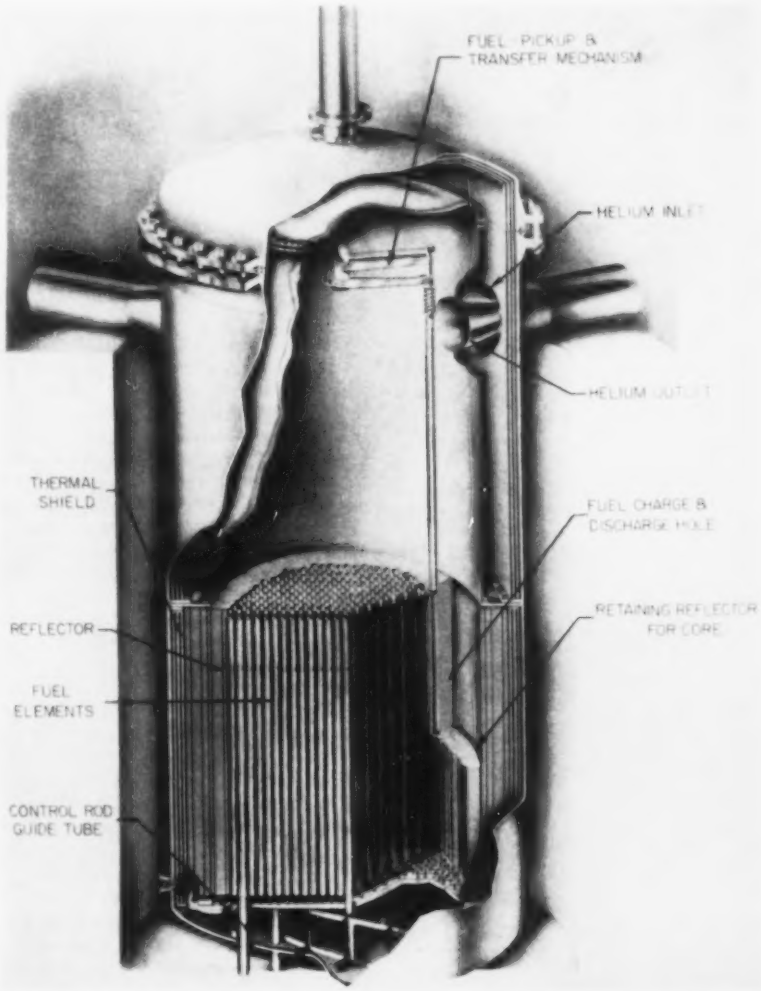
The HTGR prototype plant to be built and operated on the system of the Philadelphia Electric Co. (EWEST, Oct. p 8) is designed for a net output of 40,000 kw. It is compact and relatively simple in its design. The main steam power portion of the plant is primarily outdoor-type construction and includes the main turbine-generator and a variable frequency generator for the helium circulators. Standard steam plant auxiliaries are included. The reactor's heat output is 115,000 thermal kilowatts. Steam production is 367,000 lb per hour at modern steam plant conditions—1,450 lb per square inch and 1,000 F.

The reactor is capable of generating 1,000° steam with compact reactor steam plant equipment because of the high temperature – about 1,380 F – of the helium coolant from the reactor. Such high coolant temperatures are possible because of the high allowable temperature of the reactor's graphite-body fuel elements.

As with all nuclear power plants, the heart of the HTGR system is the reactor core. The HTGR core is composed of several hundred cylindrical graphite-body fuel elements stacked in a closely packed array. We are not talking about small fuel rods but large fuel cylinders which are approximately 12 ft in length and 3½ in. in diameter and provide large heat transfer surfaces. This is made possible because the moderator material is homogeneously mixed with the fuel.

Inside the fuel cylinders are the homogeneous fuel compacts consisting of a small amount of uranium fully enriched in the 235 isotope and a larger amount of thorium mixed with graphite. These fuel moderator compacts are operated at temperatures which give heat transfer by radiation to the loose fitting graphite cans that contain them. The loose fit isolates the can from possible dimensional changes of the fuel. The use of graphite canning and the absence of low melting metallic material substantially raises the temperature ceiling.

Thus, the homogeneous mixture of fuel and moderator provides a thousand-fold dilution of the fuel



Cutaway of the reactor vessel shows how the pressure sustaining materials are in contact with the gas at cooler inlet temperature, eliminating the need for high-temperature steels

atoms and provides a means for the conduction of heat from the fuel particles to a large surface area without the need for a very large number of small fuel elements.

Metal-clad graphite fuel elements—rather than graphite-clad ones—may be used as the initial core loading for the prototype plant while simultaneous development of the graphite-clad elements is being carried on. The advantage of this approach is that it permits early operation of the entire plant equipment and affords an opportunity for testing out the performance of all key systems and components. During the initial operation and testing phase there could be a gradual transition to the graphite-clad fuel elements because the reactor design has ample flexibility for accommodation of either type in the same over-all core structure.

Certainly, the objective is to operate the nuclear plant with the nonmetallic fuel elements as soon as possible to gain the full potential of this high performance system.

High Density Cuts Size

Because of the HTGR's high power densities as compared to other gas-cooled reactors and because of the low coolant pressure, the reactor vessel can be held to a small size and low cost. The reactor is so designed with the use of concentric duct piping that all pressure-containing surfaces, including the reactor vessel, are exposed only to the low inlet temperature of the gas coolant, that is, about 660 F. This permits the use of inexpensive structural metals.

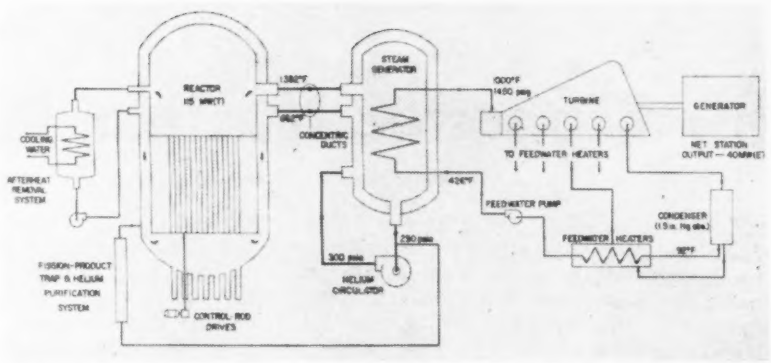
The HTGR system has a high degree of inherent safety, due to the very high ratio of moderator material to fuel. This gives the fuel elements a large heat capacity and protects the reactor core in the event of sudden power rises or changes in the coolant flow.

The reactor will have a negative temperature coefficient which, by virtue of the homogeneous fuel-moderator elements, will be prompt acting. This means that if, for some reason, the reactor temperature should rise suddenly a rapid decrease in neutron multiplication takes place and serves as a brake on the reaction.

Will It Scale Up?

The preliminary design work and evaluation studies, made in conjunction with Bechtel Corp., the prime contractor for the prototype plant, already have extended to plants well beyond the 40,000-kw prototype, and include a plant as large as 325,000 kw. There are no major scale-up problems, because the prototype is amply large to demonstrate the nuclear and engineering features for larger plants. The specific power is high enough for high burnup of the fuel to be achieved in reasonable lengths of time. The internal fuel temperatures and gas temperatures and pressures also will be approximately the same in the prototype as those required for larger plants. These features permit not only a sound extrapolation of the technical data to large-scale plants, but also a realistic assessment of the economic advantages when going to a larger size.

From the viewpoint of the plant itself, particularly such equipment as the pressure vessel, fuel charge and discharge apparatus, control drive mechanisms, pipes, valves, blowers, boilers, etc., the prototype is sufficiently large so that the equipment, once developed and tested, can be utilized as the basis for the design of larger equipment needed for full-size commercial plants.



Simplified block diagram shows how HTGR will be integrated with conventional station components. Peach Bottom plant now under construction

Core Life of Five Years

For the 40,000-kw prototype plant, the expected life of its core is three years. With a larger reactor, and resulting better neutron economy, the core life could be expected to be substantially increased. For example, a plant of 150,000 kw might prove to have a core life in excess of five years.

The use of a high temperature reactor coolant—in this case, helium—in addition to allowing full advantage to be taken of the high thermal efficiency of modern steam conditions, results in substantial reduction in capital costs of the plant. For example, a low coolant flow rate with consequent low pumping power and small reactor inlet and outlet ducts results from the high exit temperature of the coolant gas. Furthermore, the steam generators are small and compact because of the high steam pressure and because of the large available temperature differences between the high temperature gas and high pressure steam.

Economics

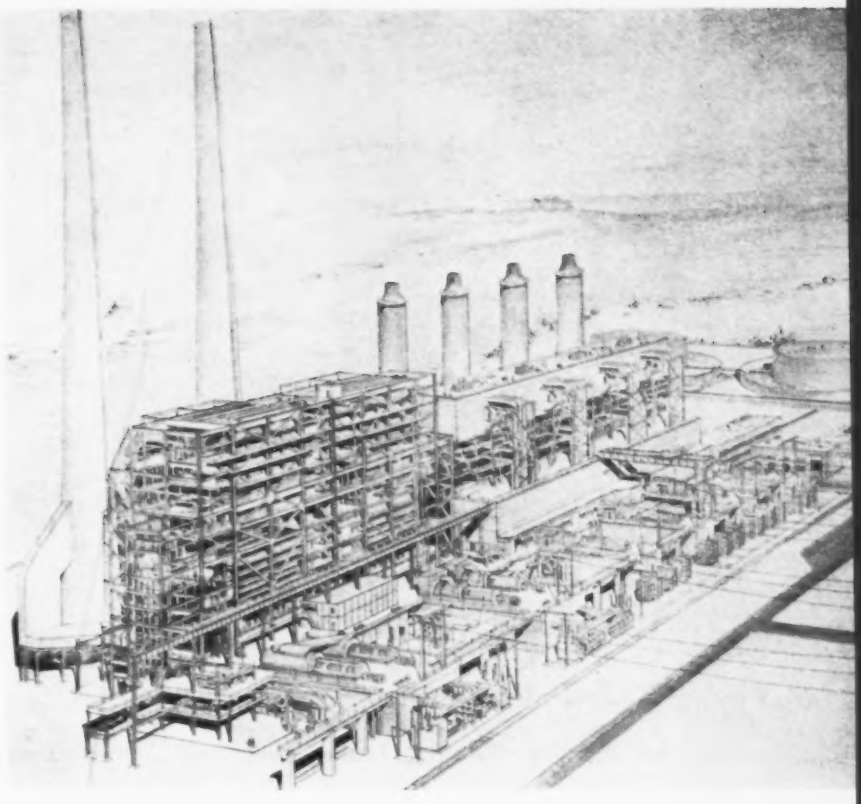
What, then, are the next steps toward our goal of economic nuclear power—once the HTGR prototype plant is in being?

What will all these characteristics mean in terms of dollars and cents? How can these characteristics lead us more quickly and more surely to the goal of economic nuclear power?

The prototype, because its capital cost (at 1959 prices without escalation) will be in the neighborhood of $500 per installed kilowatt. However, for a later 150,000-kw plant, the over-all cost of power is expected to come down to 8 or 9 mills per kwh, or close to the conventional cost in some areas of the United States.

Going one step further, to still larger plants approaching 300,000 kw, the capital cost is expected to be greatly reduced and we can expect to produce power at over-all costs competitive with conventional power in many areas. Remember these estimated power costs are based on the direct scale-up of the plant now under contract for construction and are not dependent upon future advances in technology.

Many people are convinced that the HTGR is the most promising of the various gas-cooled concepts and that it may well prove to be the most attractive among all reactor types for economic use in this country and abroad.



PG and E's original four 165,000-kw station completed in 1954 was one of the country's best. Today Pittsburg is doubling with half as many units, lots of new approaches. Here are the reasons . . .

Why Pittsburg Design Changed

D. V. Kelly, Supervising Mechanical Engineer, Pacific Gas and Electric Co.

Pacific Gas and Electric Co. is doubling the size of its Pittsburg power plant. When work is completed it will bring the total capacity of the station to more than 1,300,000 kw making it the largest steam operated plant west of the Mississippi. The new capacity is taking a different form than the existing station. It will consist of two 325,000-kw cross-compound units rather than the four 165,000-kw tandem-compound machines that make up the existing plant.

Double Unit Size

The decision to increase the size of the units from 165,000 to 325,000 was the result of an extensive examination of system generating requirements, together with the fact that larger size, lower unit cost turbine generators had become available since the construction of the first four Pittsburg units. The system study, which took into account reserve requirements, steam conditions, capital, operating and fuel costs, indicated a definite over-all advantage for the 325,000 size compared to larger or smaller machines.

The units are the first cross-compound machines to be purchased by PG and E for many years. Both shafts operate at 3,600 rpm, the high-pressure shaft consisting of a single flow hp turbine and a double-flow exhaust section and the intermediate pressure shaft having a double flow IP element and a double flow exhaust. The 192,000-kva generators of each individual unit are identical; however, the Unit 5 generators have conductor-cooled rotors and stators whereas the No. 6 generators are conventionally hydrogen cooled.

Steam conditions are 2,400 psig, 1,050 F for the main steam with reheat to 1,000 F. The 2,160,000 lb/hr boilers are oil and gas fired with a burner turn-down ratio of 10 to 1. **The net heat rate will be about 9,000 Btu per kwh operating on oil.**

3,600/3,600 Economical

The selection of the 3,600/3,600-rpm turbine arrangement instead of 3,600/1,800 rpm was influenced by the size of the parts which could be handled by the existing station crane and the fact that the inherently greater efficiency of the 1,800-rpm exhaust could not be economically exploited with the relatively warm circulating water from Suisun Bay.

After the "double thirty six" shaft arrangement had been established, investigation of driving the boiler feed pumps from the main shaft logically followed. A comparison was made between motor-driven one-half size pumps, main shaft-driven half-size pumps and steam turbine driven pumps. Studies indicated a saving for driving half-size pumps from the main shafts through hydraulic couplings. The input to these pumps at

PITTSBURG COMPARISON TABLE

Pittsburg Original	Pittsburg Addition
Mechanical	
Four 165,000 kw	**Two 325,000 kw**
1,800 psig/1,000 F/1,000 F (Net heat rate 9,550 Btu/kwh)	**2,400 psig/1,050 F/1,000 F (Net heat rate 9,000 Btu/kwh)**
3,600-rpm tandem compound	**3,600/3,600-rpm cross compound**
Conventional hydrogen cooling	**Unit 5 conductor cooling Unit 6 conventional cooling**
30-in. condenser tubes	**44-in. condenser tubes**
Separate aux. cooling water pumps	**No aux. cooling water pumps—use CW pumps**
Motor driven boiler feed pumps	**Main shaft driven boiler feed pumps**
One ½-size spare for two units	**No spare boiler feed pump**
Balanced draft with ID and FD fans	**Pressurized furnace boilers with FD fans only**
Air motor driven sootblowers	**Electric motor driven sootblowers**
Traveling screens originally 1½-hp direct drive	**Traveling water screen drive 15 hp through variable speed magnetic coupling**
Water cooled furnace television window	**Air cooled furnace television window**
Reboiler system heats fuel oil	**LP fuel system enables direct heating**
Condensate pump and spare	**Three half-size condensate pumps and three half-size boosters**
Electrical	
Single-phase step-up transformers	**Two 3-phase step-up transformers per unit—common cooling system**
Transformer BIL 900 kv—no lightning arresters	**Transformer BIL 750 kv plus lightning arresters**
Shaft driven exciters	**Motor driven exciters**
One full size motor driven spare exciter for 4 units	**No spare exciter**
Auxiliary bus has 2,400-v, 2,000-amp switchgear	**Auxiliary bus has 2,400 v, 3,000-amp switchgear**
Indoor load center at screenwell	**Outdoor load center at screenwell**
Bolted isophase construction copper bars	**Welded isophase bus, pressurized-aluminum bus bars and housing**
Control	
Semi-centralized control—large local boards at turbine boiler, etc.	**Centralized control—no local boards—operate entire plant from control room**
Steam flow signal from flow nozzle	**Steam flow signal from turbine first stage bowl pressure**
No connection between O_2 analyzer and combustion control	**Fuel-air ratio controller adjusted by signal from O_2 analyzer**
Structural	
Enclosed firing aisle and umbrella roof on boilers	**Outdoor plant except for control room & switchgear room**
Structural steel all riveted	**High strength bolts for field connections in structural steel**

full load is about 5,000 hp apiece. Inasmuch as the existing auxiliary bus in the old plant, with which the new units are connected, operates at 2,400 v, the solutions to the electrical problems to provide across-the-line starting of such big motors would have been quite complicated. The steam turbine drive appeared to increase the complexity of the plant without exhibiting sufficient offsetting economic advantages when compared to main shaft drive. Accordingly, the latter was selected for this job.

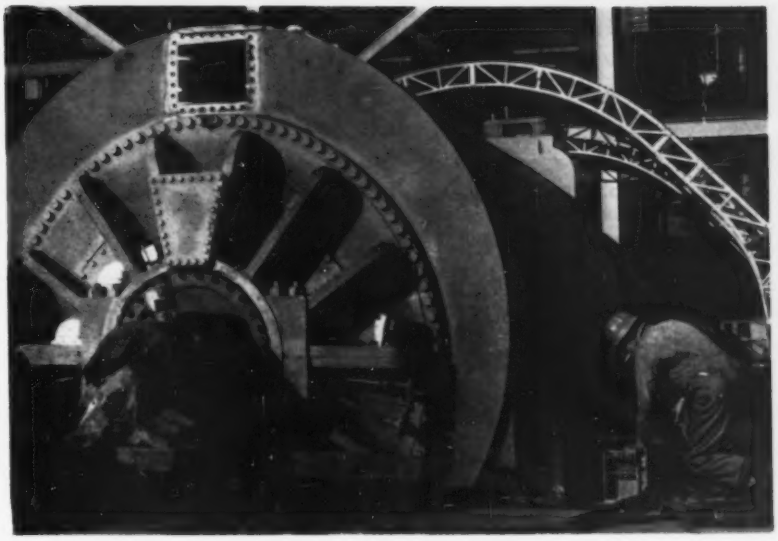
The pumps themselves are 8-stage barrel type rated at 2,700 gpm at 2,900 psig discharge pressure when running at a hydraulic coupling output speed of approximately 3,500 rpm. The mechanical couplings between the generator shafts and the fluid drives and between the drives and the feed pumps are of the conventional flexible gear type; however, one turbine-generator manufacturer is furnishing couplings between the generators and fluid drives with shear sections designed to fail and protect the generator shaft if there should be a seizure of the hydraulic coupling or the feed pump. The main turbines, hydraulic couplings and boiler feed pumps each have separate lubrication systems. There is no spare boiler feed pump.

Structurally and architecturally the plant addition will be simpler than the existing building. The umbrella roof over the boilers and the firing aisles enclosure have been eliminated. The only enclosed spaces remaining are the control room, cable spreading room and switchgear rooms.

Auxiliaries Eliminated

The condenser for each unit has two exhaust trunks, one for each exhaust section discharging into a common condenser shell. The aluminum brass condenser tubes are 44 ft long. The condenser head loss resulting from these longer tubes gave enough difference in circulating water pressure entering and leaving the condenser so that the bearing cooling water heat exchangers could be placed in parallel with the main condenser, thus eliminating the auxiliary cooling water pumps formerly required.

The draft system is of the pressurized furnace type, with two 2,250-hp fans supplying air to the 24 burners, 12 in the front wall and 12 in the rear wall. Flue gas is exhausted through a 450-ft reinforced concrete stack, the bottom portion of which



Conductor-cooled generator for unit No. 5, 330,000 kw, is approximately the same physical size as the hydrogen-cooled 165,000-kw units

contains a 300,000-gal distilled water tank.

As mentioned earlier, there are no spare boiler feed pumps with these units. On a cold start water is fed to the boilers through the idle boiler feed pumps by the condensate booster pumps. When boiler pressure has reached 400-500 psi the turbine is rolled with steam and brought up to speed, at which time the main feed pumps are then available for raising the boiler pressure to the desired value.

Still another saving was accomplished by using three half-sized condensate pumps in lieu of a single full-sized unit and a spare. Condensate pumping in the new station also requires booster pumps.

Resynchronizing Procedure

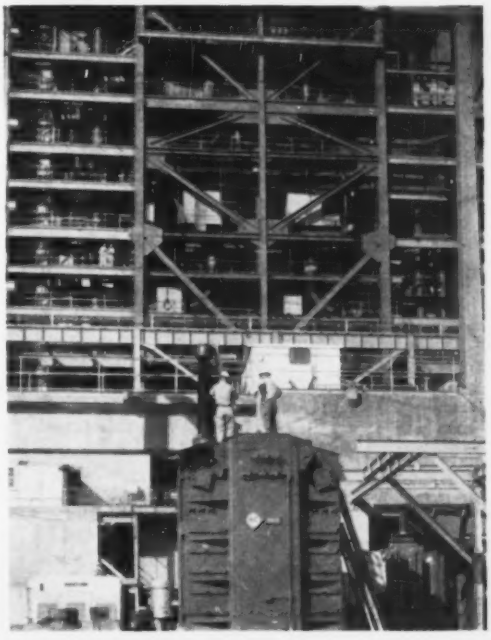
A tripout under conditions that cause the generator field breakers to open and allow the shafts to become electrically out of step presents a different problem in getting started again. In this case the steam and fuel valves are also tripped and the water level in the boiler is expected to drop to a level substantially below the bottom of the gage glass. With the generators out of synchronism it is necessary to let the shafts run down and be placed on the turning gear before they are resynchronized. During this time, which is expected to be on the order of 30 minutes, the shaft-driven pumps are not available to restore the water level in the boiler. To get around this difficulty a cross connection to the discharge of the spare feed pump serving Units 3 and 4 is being provided. Although these are 1,800-psi units, the spare pump, by operating at reduced capacity back on its performance curve, can restore the water level in the 2,400-psi boiler during the time required for the shafts to slow to turning gear speed.

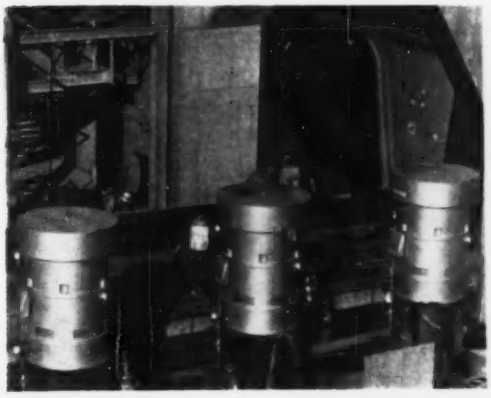
In the original station, a high pressure fuel oil system forced the designers to take extraction steam from the turbine, run it through a reboiler using steam from the secondary loop to do the fuel oil heating. The purpose of the reboiler was to isolate the fuel oil system from the primary steam system so that a tube failure would not allow oil to get into the main boiler. In the addition, a lower pressure fuel oil system made it possible to eliminate the reboiler because the auxiliary steam was at a higher pressure than the fuel oil, hence a tube failure would not cause contamination of the boiler.

It is interesting to note some of the changes in design between the four existing units and the two new ones being installed now. Differences are shown in the accompanying table and are the result of general advancement of the art of steam station design plus the incorporation of features shown to be important as a result of operating experience with the existing plant.

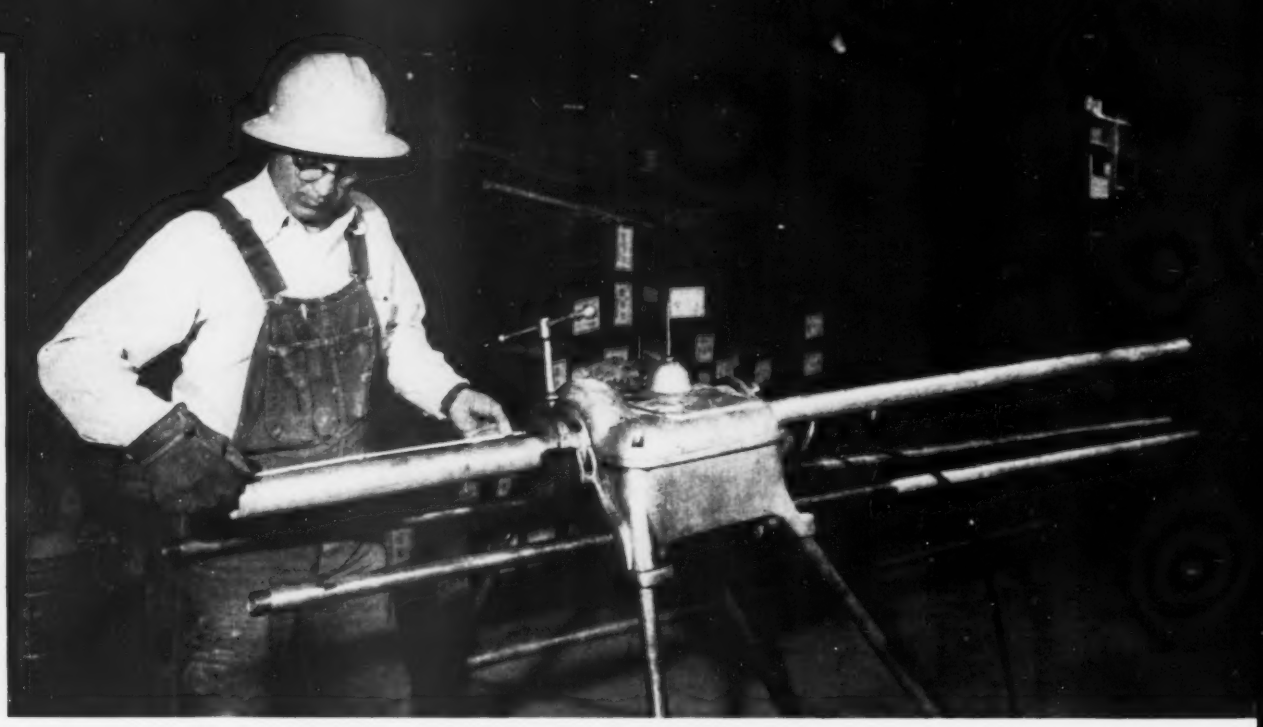
Units 5 and 6 are being designed and constructed by PG and E's engineering and general construction departments. Unit No. 5 is scheduled for operation next spring with Unit 6 to follow about a year later.

Addition has full outdoor design. Transformers will be three-phase, 750-kv BIL vs single-phase, 900-kv BIL. Also common cooling system used for transformers





Conditions required condensate pump and booster combination. Below, three half-size pumps installed vs two full-size pumps in original plant



With sharp new cutting dies and thin oil conduit threads can be cut without tearing and in less time than conventionally

No springback so the bend must be accurate the first time, using regular benders

Hydraulic benders (below) make perfect bends and elbows equivalent to factory made

What is it like

Aluminum

Steel and copper strikes have again given aluminum a strong boost as an acceptable alternate for conduit and wire in building construction. Many contractors have turned to aluminum where their loyalty to steel and copper had to be abandoned because the latter were hard to get on time. Likewise, more engineers have been specifying aluminum for a number of reasons. But what other contractors always ask those who have used it usually is: "What is it like? What has been your experience? Any problems?"

Their answers are condensed in the following from Robert Ingersol, manager of Newbery Electric Corp. branch at Richmond, as a result of a job for Union Oil Co.; and from Steve Lindheim of Schwartz & Lindheim, and George Curran and Bill Spalding of Red Top Electric Co., Emeryville and Hayward. Combined with these are the answers from Larry Hultgren, superintendent for Foothill Electric Co., the Kaiser subsidiary that is installing over 2,200,000 ft of aluminum cable and wire in sizes from No. 12 TW on up to 500 mcm RHRW and some 28,000 lb of aluminum conduit in sizes from ¾ to 3½ in. in the Kaiser Center building in Oakland. While the pictures on these pages all come from that

One man carries 3-in. conduit up ladder

Screwing conduit into fittings or strapping it to channel is easier because it is light

to install

Wire and Conduit?

job, they illustrate the way aluminum is handled by the other contractors.

CONDUIT—Light weight enables a man to carry and lift alone while climbing a ladder conduits as large as 3½ in. One man alone can hold and screw into a coupling a length of conduit, or strap it to a rack or wall.

Bends are easily made with regular hickies or hydraulic benders for the larger sizes. However the electrician must remember aluminum conduit has no springback so he must not overbend it. It must be bent to exactly the radius wanted the first time—no farther.

Threading must be done with new sharp dies. Dies that have been used on steel and lost their sharp cutting edge only tear the aluminum, do not cut it, so make poor threads.

Cutting of conduit should only be done in all but the largest sizes with a hacksaw. A wheel cutter only presses the soft metal inward and reduces the diameter at the cut end.

Protection from damage must be thought of for aluminum will not take the abuse that steel will. A crane backed into a group of conduits on a vertical wall and in swinging around sheared through the aluminum as if it were butter, one contractor told.

For casting directly in concrete some inspection departments require painting of the aluminum conduit, but Oakland did not for the Kaiser building. Had there been a corrosive mix for quick drying, perhaps it might have been required. For conduit buried directly in the soil underneath a slab a wrap of wide plastic electrical tape was given. (See pictures.)

Wire pulling is a bit more difficult, contractors say. Where there are bends in a conduit run, the ordinary fishwire or tape will cut into the aluminum as it is being drawn through. A fish wire with a ball on the end is recommended but Lindheim says he found a spirally wound fish steel worked best. Another contractor said he used steel elbows to

Ease of handling is particularly appreciated by electricians in connecting up switchboards

Cast right in the concrete floor slab

Where run underground below concrete floor slab, a wrap of plastic tape protects pipe

Conductors bunched and pulled all at once

Heavy feeders pushed rather than pulled

Connections are made with twist fittings

A bit of compound is squeezed from a tube into the wire connector before affixing it

avoid this cutting by the fish wire.

The gun type of device to propel the initial cord through a run of conduit was hailed as best by Red Top.

All wires intended for a conduit must be bunched and pulled together, others declare, and enough slack allowed so that there need be no attempt later to pull one wire a bit by itself. Once in, the friction makes it almost impossible to pull one wire more. Some insulations stick more than others. A braid-covered wire pulls best of all.

Connectors are now available for aluminum wire to solve that early problem. A bit of special compound from a tube into a twist fitting insures a corrosion-free joint of smaller wires.

On the whole there are no real problems, only little adjustments to a different material.

Is Water System Ground Doomed?

Grounding of a building's electrical system to the water mains may soon become worthless because of the increased use of cement, plastic, wrapped pipe and even cast iron with neoprene-joint pipe systems for water mains. To further deny the water system as a means of getting an electrical ground potential are recent tough regulations by the water utilities and their new practice of placing an insulating bushing between the house water lines and meter or street mains.

Because the problem has been a growing one a committee was appointed by Ernest Nelson, San Leandro chief inspector, as chairman of the Northern California Chapter of International Association of Electrical Inspectors. That committee made its discouraging report at the Oct. 28 meeting, hesitating to recommend that driven grounds be required on all installations because of further complications. To do so, however, it pointed out, is the prerogative of the individual city inspection department if further isolation and insulation of water systems makes such grounds unavailable. The committee was reappointed by the new chairman, Karl Tober, Marin County inspector, and asked to seek further a satisfactory solution to a growing problem. The full report of the committee follows:

The committee held a total of seven meetings, two of which were attended by representatives of the local gas, water and telephone utilities, and by other persons interested in metallic piping systems within buildings. We were given a great deal of assistance by these people.

When this committee was formed on Feb. 4, 1959, our responsibilities were to: (1) Obtain an official interpretation concerning the interior piping connected to the system ground; (2) prepare a drawing showing a typical installation.

Official interpretation No. 458 was obtained concerning the grounding of a service when the water pipe is insulated at the building. O. I. 458 requires the grounding to be done on the street side of the insulating fitting, leaving the water piping within the building ungrounded. We feel that this is an unsafe condition, and also note that this official interpretation was apparently not released for publication, for Nos. 456, 457 and 459 are all published in the September 1959 IAEI *News-Bulletin*.

Since we have not reached any definite recommendations, no drawings are being submitted.

We have collected the following information:

1. Water utility companies take the position that they are not responsible for furnishing a ground for the electrical system. We quote from the regulations of the East Bay Municipal Utility District, to which each of their customers must agree. EBMUD serves a population of approximately 1,000,000.

"Section 25. Prevention of Ground Wire Attachments. – The District is not responsible for providing an electrical ground through water service equipment. Accordingly, customers are cautioned not to attach any ground wiring to plumbing which is or may be connected to District service equipment. The District may hold the customer liable for any damage to its property resulting from a ground wire attachment."

Codes Conflict

This is, of course, in direct conflict with section 250-81 of the 1959 NEC which requires the use of the water piping system for grounding purposes.

2. Based on a survey by mail made of representative water utility companies in northern California, only 59% of the street mains, including proposed future changes or extensions, are of cast iron. The balance are either asbestos-cement, cement-coated steel, wrapped steel or other nonconductors (or poor conductors). Approximately 66% of the cast iron pipe made for water mains today has a neoprene-ring type of joint which means that even the cast iron is no longer a continuous pipe as far as carrying current is concerned.

3. Of the water utilities responding, approximately 25% use an insulating fitting at the main where the customer's tap is made. Approximately 12.5% insulate at the water meter. This means that for grounding purposes we can be certain only of that portion of water pipe between the water meter and the building. Or can we?

4. In dwellings, water softeners are installed with nonmetallic connections and, depending on location, might isolate the interior water piping within the building, or might isolate the electrical service grounding connection from the outside underground water piping.

5. Property owner replacement of water service piping with plastic is general.

In these last two cases, the electrical installation would presumably be inspected originally, but subsequent plumbing changes could introduce a serious hazard. These changes are often made without a plumbing permit, and the electrical inspector will have no opportunity to see that the service ground is not interrupted.

6. Insulating fittings may be installed in the water service at the building where dissimilar metals are used. To bond around this fitting (as required in the 1959 NEC section 250-112) would create a primary cell, and this bond will probably be broken by the plumber upon its discovery.

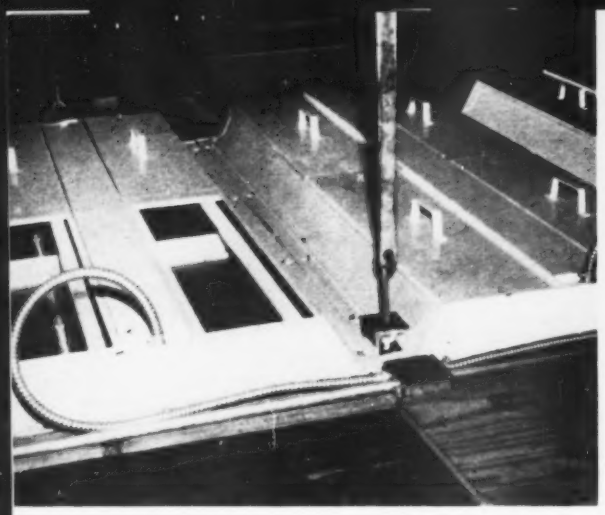
7. The 1959 California State Legislature passed Senate Bill No. 1283 amending section No. 17462 of the Health and Safety Code, which now permits piping for gas and water service lines to structures to be of steel, iron, lead, copper, brass, asbestos-cement or approved plastic.

The obvious conclusion is that we no longer have a continuous metallic underground water piping system available.

The committee was hesitant to recommend that *every* service ground to a water system be supplemented by other electrodes as required in section 250-81 "where . . . there is some likelihood of the piping system being disconnected." However, individual inspectors may certainly enforce this rule at their discretion. In this connection, we do feel that if made electrodes are used, the maximum resistance to ground of 25 ohms required in section 250-84 is not nearly low enough.

We also recommend that requirements be written into the NEC requiring the bonding (to the grounding electrode) of the interior water and gas piping within a building, to prevent a potential above ground due to accidental contacts. NFPA Standard No. 54, "Installation of Gas Appliances and Gas Piping," on page 21, section 2-9-15, requires the bonding of interior gas piping to the grounding electrode.

—*W. Creighton Schwan, chairman*



Relamping "skylight" troffers eased by removable top covers

Prismatic reflector for mercury lamp has decorative louver

Color-corrected mercury with fluorescent . . .

Relights Decorative Bank Area

MANY an ornate architecturally designed ceiling has been sacrificed in order to modernize the lighting. Not so the Crocker-Anglo National Bank main building at the corner of Montgomery and Post, San Francisco. The management demanded of the consulting electrical engineers, Buonaccorsi & Murray, the electrical contractor, Langlais Electric Co., and the fixture designer, Peerless Electric of San Francisco, that its Renaissance-classical ceiling be unspoiled and indeed enhanced by the relighting of the first floor area. This area consists of business administration offices and cashiers' working areas. Added to the problem is that the ceiling heights ranged from 12 ft to 35 ft.

How this was accomplished won for Lloyd Dehrer, chief electrical engineer with the consulting firm, and John Epperson of Peerless, both the South Pacific Regional and the National first awards in the "My Most Interesting Lighting Job" contest at the recent Illuminating Engineering Society National Conference in San Francisco.

Three types of areas were involved: office administrative with ceiling heights of 35 ft; office working areas including clerical and teller cages with 30-ft ceiling height; and general office areas with 12- and 16-ft ceilings.

Originally over the center main area was a natural skylight but it was blacked out during the war and equipped with fluorescent tubes and an egg-crate louvering, producing only about 10 f-c at desk level below. The new installation consists of 6-ft-wide fluorescent troffers in a rectangular pattern around the former skylight perimeter. These are now equipped with acrylic plastic low-brightness control lenses. There are 176 six-foot warm white fluorescent tubes used. After 100-hour burning a uniform intensity of 80 f-c is attained at desk level below with a brightness of 300 foot-lamberts at 60° angle. A new panel was installed in the attic area with a contactor control from the first floor. Relamping is done from the attic by means of detachable fixture tops.

Originally incandescent flush downlights with 500-w lamps in small aperture ceiling openings provided the general illumination and gave only 15 f-c maximum. This type of lighting was used in the areas

Urns, high and low ceiling units shown

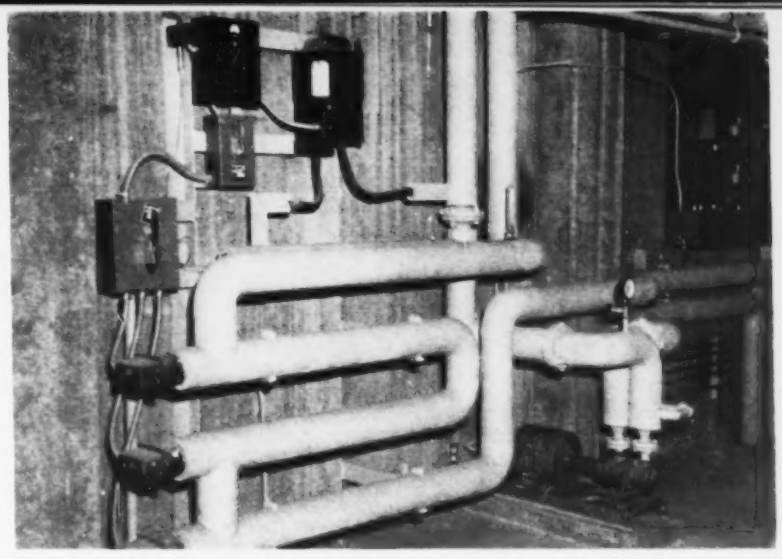
where 30-ft ceilings predominate. Such units were placed at the corners of the ornate architectural troffers.

First use was made here for interior lighting of the new color corrected mercury vapor lamps, with a burning-hour rating of 7,000 hours, to replace the incandescents. The 400-w mercury lamps are in prismatic reflectors. A metal louver in a square pattern with 1½-in. louvers, painted light cream color, is used to shield the light source.

These were installed in the same locations as the original incandescents and required no change in the wiring. In fact, the wattage per square foot was decreased by 7% and the light intensity increased over 1½ times. Initial intensity of light at desk level was 70 f-c and brightness was 1,000 f-l at a 60° angle. However, because they are mounted at 30-ft height and the brightness of the surrounding ornate ceiling has been increased both by reflection from the floor areas and by supplementary clusters of five R-40, 150-w lamps in the existing column urns and floor-mounted pillar standards the result is very comfortable.

In the low-ceilinged areas of 12 and 16 ft, originally lighted by means of flush-mounted 300-w incandescent lens units, the new system now consists of 4x4-ft, six-tube, low-brightness acrylic lens, flush-mounted fixtures with warm white tubes. In the working area intensities vary from 65 to 80 f-c and brightness measures 350 f-l at a 60° angle.

Conversion to mercury lamps for the high units results in maintenance cost decrease. Relamping from scaffolding can be done once a year instead of quarterly with shorter lived incandescents.



Immersion heaters and iron pipe resistance combine in Bellingham Hospital to . . .

Heat Oil Fuel Line Electrically

ELECTRICITY heats the oil that is used to heat the hospital in an unusual application at St. Luke's Hospital in Bellingham, installed there last year by Mills Electric Co. of that city. In adding a new wing and remodeling the older wing of the hospital, electricity was applied in many new ways—including electrically operated beds that can be raised and lowered with the press of a button, an all-electric kitchen, elevators and lighting, etc. In the basement, however, is an unusual type of electric heating using part of the iron pipe fuel lines themselves as resistance heaters. As shown in the accompanying picture, the insulated fuel lines are equipped both with immersion heaters and electrodes for the resistant heating system. Thus, the fuel oil is kept at a temperature that will provide the most economical burning in the boilers for steam heating.

A small transformer with a primary 230 v and secondary 14.4 to 18 v of 6 kva capacity provides the 16-v, 30-amp current. Leads are attached to the iron pipe. A thermocouple in the end section operating through a thermal electric control panel turns on the power as needed and off as the temperature is maintained.

Immersion heaters are 230 v and fed through a 100-amp switch. Other power requirements include oil pumps and blowers.

The job was supervised by Frank Mills. The hospital staff declares it a highly satisfactory installation. Provisions for year-round air conditioning were also made at the time.

Garden Lighted In Winter

Garden lighting need not be restricted to summer gardens, it was found as a result of garden lighting promotion by British Columbia Electric Co. in Chilliwack.

George Coombes & Appliances, the electrical contractor, sold one of the homes in the Chilliwack area five 150-w spots, a 100-w post lantern, a 100-w shrubbery light, 60-w shrubbery light, a 60-w receiving welcome light and two 60-w walk lights plus a low-wattage house number illumination sign. The customer is so pleased with the installation that he uses it winter and summer. As the picture shows, it lighted up the beautiful snow scene outside the home.

Electrical West—Vol. 123, No. 7

Motors and Controls—VIII

Classification of Motors

Tom Hughes, Electrical Safety Engineer, California Division of Industrial Safety

As stated earlier, the data concerning types and styles of motors are voluminous. A bulletin containing excerpts from the NEMA Standards can be obtained from any one of the major motor manufacturers.

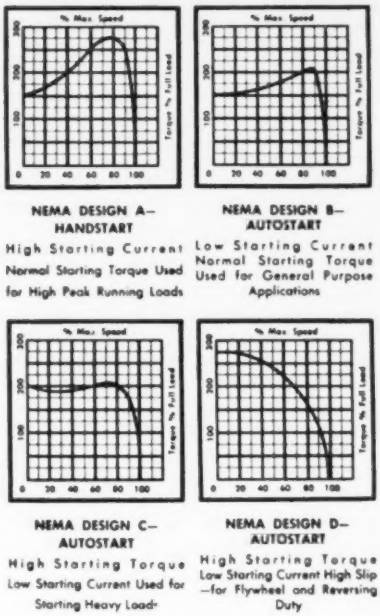
In general, motor frame sizes are classed under Fractional Horsepower and Integral Horsepower. According to their load application they are known as General Purpose, Definite Purpose and Special Purpose. The definite purpose motors are built in regular frames, but with the windings designed for other than normal service. The special purpose motors have special frames, such as totally enclosed, explosionproof, textile mill, elevator service, slip-ring, etc.

Remember, at the start of this article, we stated that we are discussing only polyphase, a-c, induction motors. Synchronous and d-c motors are usually applied by machine manufacturers, while single-phase motors are a specialty in their own right.

For starting vs running torque requirements, motors are classed in four groups, known as design A, B, C or D. Design A is a motor with normal starting torque (around 150% of the full-speed torque for a general purpose motor) and the normal starting current (around five to eight times running current) but it has specially high running-speed torque capabilities. This might be desired for a crusher or milling operation, where pullout torque must be high.

Design B is the normal general purpose motor with normal starting torque and reasonable starting current. It has a gradual increase in torque from start to a slight peak at its running speed. The actual values or percentages vary with the size in horsepower and can be found in the NEMA standard or the manufacturer's catalog data.

Design C is in the definite purpose class with higher than normal starting torque but normal starting current. Its torque is fairly level throughout its speed cycle and does not increase at running speed as does that of the two previous types. Design D has an extremely high starting torque but normal starting current. However, its torque falls off steadily as it approaches what would be the normal percentage of synchronous speed for the other types of motors. This design is ideal for continuous reversing of loads (such as on commercial-type washing machines) or for highly erratic loads where a heavy flywheel is imposed between motor and load. This might be good for crusher service, as an example. The speed of the load of this motor is unimportant but its recovery is great when it is choked down to a fraction of normal no-load speed.



NEMA DESIGN A—HANDSTART
High Starting Current
Normal Starting Torque Used for High Peak Running Loads

NEMA DESIGN B—AUTOSTART
Low Starting Current
Normal Starting Torque Used for General Purpose Applications

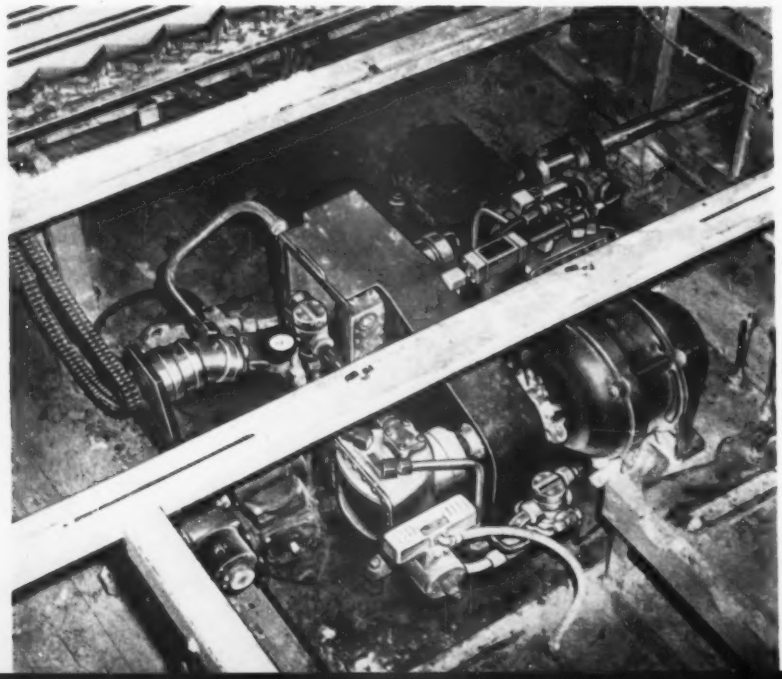
NEMA DESIGN C—AUTOSTART
High Starting Torque
Low Starting Current Used for Starting Heavy Loads

NEMA DESIGN D—AUTOSTART
High Starting Torque
Low Starting Current High Slip —for Flywheel and Reversing Duty

Motors with other than these four design letters are special purpose types and must be investigated through an applications engineer. Other design letters go with single-phase windings, torque motors, synchronous, so-called universal (series connected brush and commutator.

Then, beside these design letters, you will find on the name plate the factor, code F, for a normal general purpose motor. This indicates a "locked-rotor" kva per horsepower within a range from 5.0 to 5.6. This is a maximum figure, however, and may be more than the actual consumption of a particular motor. Code A motors have a maximum kva per horsepower below 3.15 while code M would have a maximum locked-rotor kva above 10.0.

We mention all this just to give an idea of the complexity of the application problems and, as we stated before, the wise motor user will consult a motor applications engineer of one of the motor manufacturers. This does not subject one to sales pressure because they all have comparable types in the three-phase squirrel-cage motors.



Versatile speed control that eliminates motor stresses caused by frequent starts

ELECTRICAL WEST
Construction News

For
- -contractors
- -consulting engineers
- -lighting engineers
- -wiring designers
- -distributor salesmen
- -all interested

Hawaii was assigned to the Pacific Northwest states because Portland is a few miles closer to the Islands than is San Francisco or Oakland. This was at the national convention of National Electrical Contractors Assn. in Miami and District 6 won out over District 9. At present, there is no chapter of NECA in Hawaii, although Warren Penn, former Los Angeles Chapter manager, sought to have one started there. It will be up to Portland now to organize one, having won the jurisdiction.

The Currans

Contractor visitors to the 50th state are numerous, however, and among them were Mr. and Mrs. Frank Curran, Victorville, Calif., contractor, who celebrated their 25th anniversary there at the Surf Rider. . . From Portland General Electric Co.'s winners attending its Medallion Home workshop and wiring a Medallion Home, Mr. and Mrs. John Lambert got a free flight to Hawaii.

Keep Pace Electrically is the theme for the commercial and industrial program by the National Wiring Bureau as a counterpart to the Housepower and Live Better Electrically programs in the residential field. Its emblem, at right, will be featured in national advertising and will be backed up by NECA in its promotion. A complete variety of promotion and advertising material will be made available to tie in with the theme.

KEEP PACE ELECTRICALLY

Wire companies have been getting calls from customers who forgot them all through the wire market chaos, when brokers took orders too cheap and promised deliveries that could not be made. It's an old song—"I'm gonna dance wit de guy wot brung me," but it needs revival. Premium prices for wire and conduit are reported to be offered in southern California to keep jobs moving.

Senator John Kennedy of Massachusetts, testing labor's attitude toward him after passage of the labor reform bill by Congress, as well as his chances as a presidential candidate, asked to address the 20th anniversary luncheon of the California Apprenticeship Council of the electrical construction industry, sponsored by Alameda Branch, Northern California Chapter, NECA, and IBEW Local 595. At the head table were Herb Bowen and Charles Turner, representing contractors, and Harry Kurt (behind Kennedy, speaking), assistant manager 595, Oscar Harbak, vice-president, District 9, IBEW, and Dan Ryan, president of Local 595. Kennedy explained his efforts to tone down the Landrum-Griffin bill in the interest of protecting organized employers and labor and permitting construction industry prehire agreements.

San Francisco's streetcars (all electric) carried Santa extolling ample Housepower as the ideal family gift and advising to call a "Qualified Electrical Contractor" for it. It was sponsored by the joint industry committee of San Francisco Electrical Contractors Assn. and Local 6, IBEW, for the holiday season.

To open the organization to all areas, the name California was deleted from the new Conference of Electrical Bid Depositories at its second semiannual meeting at the Claremont, Berkeley, Nov. 20, Tom Ryan, manager of the East Bay depository, its president, announced. Besides Ryan, John McManus, new manager, San Francisco depository; William Buchan, new manager of Santa Clara-San Benito depository; Jeff Cunningham, San Mateo; Al Slater, vice-chairman, Los Angeles; W. A. Ferguson, Orange County; and Joe Krivanek, Sacramento; O. E. Carlisle of Kansas City depository attended. The group is seeking to develop standardization of bidding procedures and policies.

An Equipment Expense Guide, giving rental rates for a wide variety of tools used by electrical contractors, has been completed after two years work by the Los Angeles Chapter, NECA, for its members.

Ralph E. Carlson, California state fire prevention engineer with the state's fire marshal's office in San Francisco, has been promoted to a new position in Sacramento to write up standards and recommendations regarding the fire codes and fire-resistive materials. A new short law passed at the last legislature sets up such a requirement of the department, although a definite list of materials has long been needed.

Bill Gribble

Among People in the News—"Chico" Bill Gribble, since 1935 the Thermador missionary of fan electric heaters, electric ranges, especially the built-in ovens and cooking tops in northern California, and before that a contractor in Chico and appliance salesman for Edison, was given a testimonial dinner attended by the most complete cross section of the area's electrical destiny shapers as he retired last month. . . Arthur Dahl, originally a contractor, then for years manager of supplies at G-E Supply, San Francisco, is back in contracting. After his retirement Nov. 1, he became sales engineer for Charles A. Langlais Co., contractor, in the latter's Western Switchboard Co. . . Jack Cottingham, Portland General Electric Co. lighting specialist, was appointed to succeed Beverly Travis, Seattle consulting engineer, who resigned as Pacific Northwest regional vice-president of Illuminating Engineering Society. . . Andrew Hannon, former president of Los Angeles Chapter, NECA, has been giving talks on "Design of Sound Systems for Commercial and Industrial Applications" to EMEA and AIEE Construction Division audiences. The EMEA Pomona area section, by the way, has renamed itself "The Old Baldy" for its nearby mountain peak. . . Maurice Lanning of Sutton & Frost Electric, San Francisco, has been elected president of a newly formed Associated Subcontractors of California, a state association to deal with governmental relations.

Clarence Pierce, IEEL president (left), with Bob Brandon, chairman of the appliance section, and Randall Johnson, WWP advertising supervisor, planned Spokane's MYHHWANA to show . . .

How to Make Homes Happy

Distributors want a repeat on the MYHHWANA Appliance Festival, sponsored in Spokane by the Inland Empire Electrical League. Virtually every major brand of major and portable appliances was represented at the festival, which tied in with the November promotion of Make Your Home Happier With a New Appliance, prepared by the Bureau of Advertising, American Newspaper Publishers Assn. The show in the Washington Water Power headquarters building was open one day and two evenings. The program included demonstrations and talks of interest to homemakers.

Late models were displayed in WWP's Spokane headquarters

Prospect looks at a Westinghouse refrigerator-freezer combination

Robert N. Wohrle shows portable transistor TV, an attraction at the Graybar exhibit

A. L. Hershberger of Hotpoint demonstrates features of a built-in electric oven unit

John R. Connolly, Sunset Electric Co., shows off a new Frigidaire dishwasher

From shear to heavy, wash and wear fabrics were modeled and laundered. Women models were members of Billings Junior League

Wash 'n Wear Fashion Fair shows

What's New and How to Care for It

"One bee cannot make honey—it takes the whole colony." That's the principle on which Dee McGonigle of Montana Power Co. founded Electro-Day, a coordinated newspaper advertising program that takes the electrical industry into the market place together once a month.

Because the unified concept has worked so well, it was natural that when Electro-Day people began planning their tie-in with EEI's All Electric Laundry Festival they brought in fiber manufacturers and local dry goods merchants.

Thus the two-day Wash 'n Wear Fashion Fair in the Billings Shrine Auditorium was turned into a coordinated educational effort to clear up a lot of misunderstanding about laundry equipment (dryers in particular) for the public and for salespeople.

The show that brought out more than 3,700 (some of them driving miles through the rain) did not just happen. When distributors and utility people met to exchange ideas and make preliminary plans for the festival, they decided that it must be a top flight show. They chose Bob Cooke of Montana Power's Billings office as chairman and Clarence Kommers, residential sales supervisor in Butte headquarters, as co-chairman.

On advice of home equipment editors, industry association leaders and others, Lee Ballard of New York City, an authority on fibers, fabrics and home laundry methods, was secured to emcee the show.

For the style show Miss Ballard brought along New York fashions available in Montana shops. Three garments were given away at each show. Miss Ballard's talk commented on styles and fabrics, told how they could be laundered safely in top-of-line equipment. It was an entertaining and common sense talk, calculated to do away with fears and to

Show headliners: R. F. Cooke, Montana Power; Lee Ballard, June Mohler, Lee Ballard Associates; C. P. Kommers, residential sales supervisor, Montana Power

instruct women in fabrics and laundry methods.

"Wash and wear means what it says," she emphasized, "but garments must be processed with wash and wear finish. The laundry equipment can't do that." The word "drip-dry" was ruled out.

Clothing was washed during the show. Miss Ballard introduced and identified with their local distributors, visiting home economists and representatives of the sponsoring equipment manufacturers. These factory people were ready in their booths following each show to demonstrate features of their own equipment. Make of equipment for the prize drawing was chosen by lot.

Shows were kept to 1½ hours, though displays were continuous. There were two afternoon and two evening shows and a morning session that brought out 400. A preview was given the evening before the opening for dry goods store managers and salespeople.

Those attending registered and gave information on equipment owned, thus furnishing a large prospect list.

Promotion was started with small newspaper ads and increased as show time drew near. A double truck color ad appearing just before the festival carried a coupon offering free booklets on general washing rules and specific instructions for handling wash and wear fabrics.

Out of pocket cost of the show was $4,200, including the garments given away. All sponsors contributed, with Montana Power Co. acting as trustee. Cooperating manufacturers were Hotpoint, Kelvinator, Maytag, Norge, Philco, RCA-Whirlpool, Speed Queen and Westinghouse.

All sponsoring distributors displayed new laundry equipment. Here Lee Crandall, Hotpoint, can be seen at left; Al Brey, dealer, center; and Neva Rieve, at right

Visiting home economists appeared on TV. Seated: Mary Kelly, Philco; Neva Rieve, Hotpoint; Virgina Van Nordstrand, RCA-Whirlpool; Jessie Cartwright, Norge; Joan Beasley, Maytag; Bernice Stillwell, Westinghouse; Billie LeSeur, program moderator; standing; June Mohler, Katherine Nichols, Juanita Rike, both of Midland Implement Co., Billings; Lee Ballard, who conducted the style shows at the festival

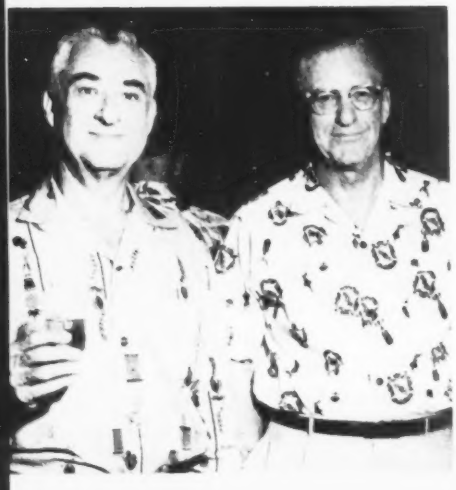
Billings apparel shops tied in with window displays like this one showing wash and wear clothing for various members of the family. A card advertising the Festival is prominent in foreground

Mr. and Mrs. James B. Marr Jr. (right) were winners in the equipment drawing. They are congratulated by Mary Kelly, Philco, and W. H. Cain, Northwestern Auto Supply distributor

Foreground, Reagan Quinton Mrs. Doering Maytham Mrs. Wikle Host Ralph Johnson Mrs. Reagan Walker

Seventh PCEA Hawaiian Conference shows how . . .

Hospitality Builds Load



Chairman Herb Heinrich (left) and Dick Doering greet mainlanders, set the climate for island hospitality

In the congenial atmosphere of aloha shirts, a large mainland contingent of Malihinis joined their Island hosts for the seventh PCEA Hawaiian conference.

Opening speaker of the general meeting was **Howard Arnett,** vice-president of Portland General Electric Co., who addressed himself to the task of analyzing "Why this meeting." He looked beyond the obvious benefits which can accrue from a tangible improvement in operation. Drawing on de Tocqueville's analysis of democracy in America, he pointed out that in a democracy with all men equal before the law there is a natural tendency to form voluntary associations because of the concomitant individual weakness which goes with equality. He pointed to the importance of communications and holding together and making effective these voluntary associations which are so much a part of our life. He said, "The important thing is that the function of communications, and all that is dependent upon it, is being served. In this sense individuals and groups are the channels through which this action takes place and, in pursuing their objective of self-interest, are in reality serving a much broader purpose."

Chairman of the Board of the Rochester Gas & Electric Corp.

Robert E. Ginna assessed the world's energy requirements and energy resources and concluded that we must look to atomic energy on a world-wide basis or much of the world will be unable to achieve a standard of living and type of industrial development that we have attained in this country. He reviewed the nuclear plants, which have been completed and which are under construction, giving special attention to the high-temperature, gas-cooled reactor concept developed by General Dynamics and which is presently being built by the High Temperature Reactor Development Associates, of which Mr. Ginna is president. He lauded the prototype approach that this country has taken, which gives us the opportunity to gain experience with several different conceptual prototypes and therefore make the best use of the years when conventional fuels are still more economic than nuclear fuel.

Drawing an analogy from the Hawaiian atmosphere, **Sherman R. Knapp,** president of the Connecticut Light & Power Co., stated that area development itself is, in large part, a matter of climate and atmosphere. He then went on to show how area development required some subjugation of individual's rights for the constructive development of the whole community. Thus, planning and zoning become key factors in area development. All this affects the business climate of the community and bears on the fact that while machines don't care where they work—people do. Thus, many industries today are more inclined to locate near colleges and universities—in constructive communities—than in a less responsive market center. Summing it up he said, "We found out a long time ago that the biggest factor in area development was the business climate of a community—the attitude, beyond any count of hands, of the available working force, the existing businesses, the local leaders and the general public."

Walter J. Maytham, vice-president, Westinghouse Electric Corp., sketched the dimensions of an action program for building business electrically. He presented figures which indicate at $54 billion new electrical building construction market in the next decade and then went on to say that an equal amount would be spent for electrical modernization of existing buildings. He presented figures to indicate that already the majority of the nation's building owners were looking forward to electrical modernization and then suggested an industry teamwork approach would demonstrate to the building owners the economic advantages that went with electrical modernization. He continued, "All our case histories to date show that results can grow and grow and in the end become just what that group of determined electrical men have demanded for themselves."

Speaking on expanding our horizon, **A. C. Monteith,** vice-president of Westinghouse Electric Corp., commented on the growing importance of planning and integration processes as being the key to important future developments. As an example of a development that encompasses both planning and integration, he discussed power casting—a new method for system planning which is both farsighted and encompasses all of the variables that must be considered in order to eliminate the risks of a wrong decision in a continuing expansion program.

By placing a mathematical model of a complete power system on a digital computer, the power casting process compresses 20 years of system operation into a few minutes and then prints out the whole expansion program showing the dates when additions will be needed.

Another significant development will be the marriage of computer type devices and controls to give reasoned performance to manufacturing control.

Another area where planning and integration could be tremendously productive is in the American home. "For example, the refrigerator, dishwasher and range are pouring heat into the house, while the air conditioner is trying to remove it. The laundry equipment is dumping Btus down the drain, while the furnace and hot water heater work overtime to bring them in."

Looking ahead in the appliance picture, **W. P. Von Behren,** general manager of the Major Appliance Division of General Electric Co., first commented on appliance service as a road block to increased appliance sales. He indicated that manufacturers must simplify and componentize their design so that less service will be required and so that when it is required it can be more quickly

Robinson Gulf States Utility **Mrs. Robinson** **Yates** Bechtel **Lengnick** HECO **Mrs. Yates** **Mrs. Lengnick**

Harry "Pop" Hartzell, left, PCEA President Charlie Wikle, Speaker Arnett take a hint from Hilo Hattie—"Watch the Hands"

Highlight of Hawaiian Electric's luau, taking the pig, fish and lau laus from the Imu

and inexpensively carried out.

In a striking contrast to engineer Monteith's ideas of appliance intergration in the home, marketing man Von Behren foresees appliance fragmentation as a probable trend. In the home he described, there are at least six logical places for refrigeration—including a refrigerated medicine cabinet in the master bath. In at least three locations—kitchen, recreation room and bedroom—there can be cooking devices. A full capacity washer and dryer could be used for the laundry and a small combination washer-dryer in the master bath.

C. C. Walker, vice-president of General Electric Co., sketched some new responsibilities for business managers. One of these, for instance, is an active interest in the political climate of the community. He said, "There are very few businessmen who regard political affairs as part of their managerial assignment. This must change." He went on to state that businessmen have two political responsibilities—"one, to speak out on the issues that affect the ability of their individual business to serve the public, and two, to work for and contribute to the political party of their choice as individual citizens."

E. L. Robinson, vice-president and general sales manager of the Gulf States Utility Co., discussed his company's approaches to load building on the Louisiana-Texas Gulf coast. Of particular interest to the group was his company's method of handling large petroleum processors with some ingenious rates that enable a customer to have the kind of service he feels his plant requires. This takes the form of a facilities charge, which enables the utility to provide spare transformers, extra breakers and the like, since the customer is paying the freight.

In the field of residential sales, he described the program of wiring subsidies his company uses for high-use appliances and concentrated on his company's promotion of the heat pump. To encourage this, a winter-month rate improvement from 1.5c per kwh in the summer to 1.17c for the final block of power has been adopted. The mass approach to the sale of heat pumps is apparently beginning to take because they are finding their way into the lower medium priced homes.

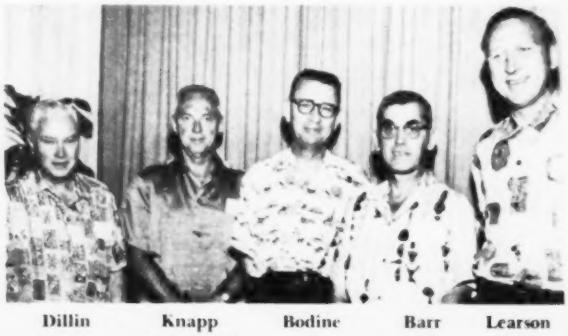
Administrative Services

Sherman R. Knapp, Connecticut Light & Power, described his company's manpower training, which consists of sending some 50 executives to a four-week management school. Thus trained, these members then presented a six-day version to their supervisors. President Knapp's evaluation of the effort was that the greatest benefit came from a common understanding of the many business terms which today's executives are called on to use and understand.

Reviewing the key role the utility industry has had in applying data processing equipment, **T. Vincent Learson,** vice-president and group executive of the IBM Corp., traced the growing use of accounting and computing machinery from the early 1920s when punched cards were first used for the preparation of customers' bills to the present when engineers are making wide use of digital computers for system studies and design and into the future when power stations and, indeed, whole systems will be controlled by on-line computers.

The subject of pricing watts received an adept treatment by **H. G. Dillin,** vice-president of San Diego Gas & Electric Co. There are a good many incompatible ways and methods of pricing watts. This is the reason that utility management should take an active interest ("it's a thinking man's subject") in the preparation of rates to make certain

Hansen G-E | **Monteith** W | **Dean** HECO | **Lowe** Kaiser | **Williams** HECO



Dillin SDG&E | **Knapp** Conn. L&P | **Bodine** W | **Barr** G-E | **Learson** IBM

that rates are designed to fulfill the company's obligations and objectives. The most important ingredient in a good rate structure is the matter of judgment. Thus, rates can become overly complicated and entirely untenable from the public's point of view even though entirely fair from the point of view of a rate engineer. In summary he said, "Our aim should be for a rate structure which is simple, yet containing the necessary features which flow from cost, value of service and other consideration, without being unduly discriminatory and which will provide fair return with best acceptance by our customers."

Frank Bodine, Westinghouse Electric Corp., represented the view of a salesman in treating the subject of "keeping them satisfied." In the taken-for-granted climate where electric power service exists the handling of complaints, preventive maintenance and appliance service, the handling of complaints is an important part of keeping them satisfied.

Another important and positive way of appealing to users is to obtain an active home service department. Mrs. America is being recognized more and more as a key figure in shaping thought, and this seems to be an excellent reason for continuing, even increasing, home service operations.

Business Development

In a behind-the-scenes look at big league appliance marketing, **W. P. Von Behren,** General Electric Co., made some very interesting and penetrating observations. For instance, the husband, not the wife, makes the final decision, or participates equally in more than 50% of the appliance purchases **but** the wife clearly dominates in the more technical areas such as which model, style or features will be purchased. He also stated that 90% of the people who go shopping for a major appliance have a particular brand in mind before they leave home. He then indicated that only 50% ended up buying the first brand they had in mind—a tribute to appliance salesmen. Another interesting fact was that the number one brand in a major appliance sales in any market will be the leader in advertising lineage.

Nela Park's **A. C. Barr** presented an illustrated glimpse of "new frontiers in lighting." He told about the rapid acceptance of new lighting levels, new tools to sell lighting "up" and showed some of the new products just over the horizon. Then he included new vertical filament and quartz line lamps, improved mercury types, and outdoor fluorescent, square fluorescents and coloramic lamps. He predicted a steady gain in foot-candle illumination with benefit for all.

Walker G-E | Knapp Conn. L&P | Ginna Rochester G&E | Maytham W | Robinson Gulf States Utility | Arnett Portland G-E

William E. Melarkey, electrical engineer consultant for the city and county of Honolulu, pointed up the difficulty encountered by engineers and architects who are constantly encouraged to do a half-way electrical job. He said, "all hands" should assist these people to sell adequate wiring to building owners. He urged a case for adequate equipment to be presented from an investment point of view—one which owners can evaluate.

Engineering & Operating

In the engineering and operating section **A. C. Monteith,** Westinghouse Electric Corp., supposed manufacturers had ceased to develop and improve their products in 1939. With this supposition, he described present-day systems based on 1939 vintage equipment. In a single comparison, he indicated that using the efficiency of 1959 generating equipment investor-owned utilities would be spending $750 million a year more on fuel alone. He then indicated that developments in the next 20 years will be equally startling and went on to sketch developments under way in the fields of generation, transmission and atomic power which are in the works and will be part of 1979's story of progress in the two centuries ahead. He concluded with a statement by Charles Kettering, "With willing hands and open mind, the future will be greater than the most fantastic story you can write. You will always underrate it."

In a discussion of the applications of gas turbines, **Alf Hansen,** General Electric Co., discussed the broad areas of application of the gas turbines which are presently serving in many industries. Concluding, he indicated that two of the most promising areas for the application of the gas turbine in the Hawaiian Islands would be for peaking as well as for combined cycles to improve the generation plant efficiency.

Tom Lowe, Kaiser Aluminum, and **Melvin Dean,** Hawaiian Electric Co., presented their findings on the effect of extreme marine atmospheres on the corrosion of connectors and pole line hardware. The subject will be treated in greater detail in a forthcoming issue of ELECTRICAL WEST.

On parting, aloha seemed strangely inadequate for expressing thanks to Herb Heinrich and the other Island PCEA members for a most memorable and rewarding experience.

Hale Cheatham laughs as Hilo Hattie encourages Rita Coughlan to try the hula —she was great!

Conference planning gave time for between session meetings and talks with friends

With realism and confidence

RMEL Faces the Future

American industry's opportunities and responsibilities were given realistic appraisal at the Rocky Mountain Electrical League's 56th annual convention at the Broadmoor in Colorado Springs, Oct. 25-29. Speakers did not pull any punches as they looked at the free enterprise system, effect of inflation, progress in missile development and atomic power.

This hearty fare was balanced by entertainment provided by the hosts and free time to enjoy the beautiful setting and its recreational opportunities. The following excerpts from talks give only a few of the thought-provoking comments and suggestions.

Warning that, through inflation, we may price ourselves out of world markets, **Senator Gordon Allott** of Colorado put the responsibility on all segments of our economy to face and solve this "most important domestic problem before us as a nation."

Pointing out that we are in trouble in meeting competition in world markets and from foreign producers in our own domestic market, he stressed the significance of inflation for the United States position in the world. "In the background of this problem looms the Soviet Union's economic and trade offensive. Thus our very national survival is at stake."

Rejecting direct controls on prices and wages, he called for a creative approach of positive, practical policies. He would pursue more vigorously the basic policies of the Eisenhower administration: (1) balancing the federal budget; (2) following wise and flexible monetary policies; (3) encouraging sound labor-management agreements; (4) declaring our anti-inflation objective to keep the whole world on notice of our firm national resolve to keep the price level stable.

"Congress should pass in the next session a bill to amend the Employment Act of 1946 so as to state clearly that our goals of economic policy include not only full employment and maximum production but also a stable value of the currency," he declared.

The industry's greatest threat does not come from organized groups but from true believers in the free enterprise system, who put a "but" before utilities, according to **Allen S. King,** president of Northern States Power Co. and of EEI. Motivated by their cash registers, this group has sampled the cheapness of public power and likes it, he pointed out. Greatest lobby against adoption of the Hoover Committee's recommendation to sell TVA facilities to neighboring utilities probably would come from businessmen in the area who know that, under business management, rates must go up.

Because workers don't realize what free enterprise has given them, each company should do something in its own operating area to get the story across in a simple way, he believes. Let's start on Main Street, he urged. Our people would not vote for socialism but they can get it by small steps through ignorance.

Henry Sargent's paper dealing with the benefits of coordinated development of the U. S. and Latin America was read in his absence by **Sam A. LaFase,** vice-president of sales and publicity, Ebasco International.

Importance to world peace and understanding of exchange visits with technically trained people in other countries was pointed up by **J. L. Singleton,** Allis-Chalmers senior vice-president, and immediate past president of NEMA. Singleton toured the Soviet Union a little more than a year ago and recently was host to a Russian delegation at Milwaukee.

Quoting from Krushchev's speech at the dedication of the Kuibyshev power plant to show that power generation is of prime importance in the Russian economic war with the West, Singleton said that the United States is Russia's personal opponent in this warfare.

While technical reports are prepared by sincere scientists and engineers who for the most part stick

Program planners: R. D. Moody, Allis-Chalmers, general chairman; Donald T. Spangenberg, PS of Colorado, program; George K. Helbock, Square D, sociability

to the facts, he said, it seems obvious from inconsistencies that they have been reviewed by others who have injected politics.

Singleton believes that when the Russians refer to total generating capacity of 48 million kw they are definitely including all power, whether utility or industrial. He would reduce this closer to 30 million to compare with the U. S. figure of 160 million kw. It is his opinion that Russia is not emphasizing its nuclear energy developments.

From what he saw in Russia, Singleton believes Soviet theory is on a par with ours or ahead in some areas but that it lags behind in practical application of science and engineering; design is sound but also behind ours; workmanship and quality of materials do not measure up at all. He estimates that Russia is 25 years behind us in steam turbines, transformers, motors—in just about everything with the possible exception of hydraulic turbines. "Most of the products I saw would not be good enough to sell in this country," he said.

We've got problems, not because we're weak but because we're winning, it was pointed out by **Dr. Kenneth McFarland,** who appeared at the conference through the courtesy of General Motors. We've got to teach the free enterprise system from the ground up, he declared.

Free enterprise or disaster was the choice given by **Dr. Nicholas Nyaradi,** director of the Institute of International Studies at Bradley University, Peoria, Ill. His eloquent luncheon talk was inspired by his own experience, and an attentive audience heard him urge businessmen to stop talking to each other and start a home town crusade to tell people what America means. "If we don't know our privileges, how can we defend them?" he asked.

Because businessmen have negated their responsibility in politics, the vacuum has been filled by those who are not such ardent believers in the American way of life, said **Wingate Lucas,** General Electric Co. Politics is a fascinating game and is more fun than businessmen generally realize, he declared, and such service could broaden one's opportunity within his company while it stabilized our system. Industry has overlooked its opportunity to encourage younger men to move into the field of politics permanently or temporarily, he believes.

U. S. capability must increase with the threat, said **Col. William S. Rader,** Commander 13th Air Division, SAC, in speaking of the role of the strategic missile in national defense. This means time and money, hardening and toughening.

The talk of **C. Arthur Rolander Jr.,** General Atomics Division, Generla Dynamics Corp., is printed in part on p 66.

Calling for a consistent program of monetary and fiscal management as the only means of attaining the goal of stable prices, **Jack K. Busby,** president, Pennsylvania Power & Light Co., suggested four points of action as a groundwork.

1. Stability of the price level should be a formal goal of national economic policy.

2. The supply of money should be increased at approximately the same rate as increases in output of goods and services.

3. Federal government tax and expenditure policy should be such as to help reach the goal of price level stability.

4. A large number of government activities should be re-examined and in many cases eliminated. We have been treated to statement after statement as to the difficulties of eliminating inflation in an economy characterized by price rigidity especially on the down side. However, the fact is that today the greatest single source of price rigidity in the American economy is the federal government itself. The public must be made to realize that the largest source of price rigidity is the federal government itself, that the greatest promoter of monopoly practices in America is the government itself.

Inflation can be licked by the recognition of price stability as a principal economic objective and by devoting the full resources of intelligent monetary and fiscal policy to this end, he believes.

In 1960 the appliance, Medallion Home, Light for Living and Housepower programs will appear as one unified Live Better Electrically campaign to the consumer, **William M. Shepherd,** vice-president, Arkansas Power & Light Co., said in outlining an EEI program that represents four months of intensive work by 140 sales executives.

Other objectives for 1960 are to sell electricity in a positive, affirmative manner, with particular stress on the highly competitive, load building areas and to broaden the scope in two important areas: the Medallion Home, which will now be heavily dependent on EEI national leadership, and the vitally important subject of residential electric heating and cooling.

Two major media—mass circulation magazines and daytime network

RMEL President J. E. Wilson, Colorado Central Power (right), with Allen S. King, Edison Electric Institute president

Incoming president, Robert T. Person, PS of Colorado (right), with Wingate Lucas, G-E government relations consultant

Below—C. A. Rolander Jr., General Atomics Division, General Dynamics, and Earl J. Nelson, ALCO, RMEL vice-president

W. M. Shepherd, Arkansas P&L, and J. L. Singleton, Allis-Chalmers, speakers at the Tuesday general session

Ralph Hubbard, RMEL manager, with his successor, B. P. Montagriff. Hubbard retires after 15 years with RMEL

television—will be used to get massive coverage of people with repetitive competitive sales messages.

"The home of tomorrow and the power system of tomorrow demand very little new knowledge—only a new philosophy of planning. Both require us to stop thinking in terms of components and start thinking in terms of systems." This was the contention of **Dr. J. A. Hutcheson,** Westinghouse vice-president, who stated at the outset that he was going to talk plainly about progress that has not yet been made.

If the industry is to maintain the residential load growth pattern of the past, Henry, the average customer, must be freed from the scientific hodgepodge of compounded contradictions it has created for him, Hutcheson believes. Henry wants refrigeration, not a refrigerator; hot water, not a water heater. Therefore, the home might well be built around a core unit, with modules of the single unit performing all essential services, many functions being combined.

The service unit core would be sold as a single item and would be designed for over-all minimum cost, achieving every economy of automated manufacture and assembly.

Research and development for this home of the future has already started. The same system principle applied to the industrial and commercial markets can bring equally interesting improvements and we're doing interesting things about these markets too, Hutcheson said.

In expanding to meet the loads of tomorrow, the emphasis should be on building and optimizing pieces, he believes. "It is futile for us to go on spending our research and development dollars to optimize pieces and for you to go on putting power systems together like they were erector sets." To eliminate wrong decisions, Powercasting (see A. C. Monteith's talk, p 85) is offered.

President Wilson announced the retirement of Ralph Hubbard, RMEL manager for 15 years, and paid tribute to his service in advancing the association. Hubbard, who has been in the electrical industry for 46 years, will be succeeded by B. P. Montagriff from Public Service Co. of Colorado.

Robert T. Person, president of Public Service of Colorado, was made league president, succeeding Wilson.

Dr. J. A. Hutcheson of Westinghouse

1960 officers: P. E. Brookover, Cheyenne LF&P, vice-president; H. A. Mitchell, PS of Colorado, treasurer; W. L. Duncan, G-E Supply; Warren Terry, Home L&P, vice-presidents; President Robert T. Person. Missing from the picture is Neil Simpson, Black Hills P&L, a vice-president for the coming year

KELLOGG ENGINEERS

BUILD LONG LIFE

INTO POWER PLANTS

With costs of downtime constantly climbing, the soundest investments in new central stations today are those engineered for optimum protection against failure tomorrow.

This is one of the reasons why The M. W. Kellogg Company, worldwide engineers and builders of plants for basic industries, is so frequently charged with the execution of large capital expenditures by electric utilities—one industry vital to all.

In central stations functioning 24 hours every day, a major Kellogg responsibility is to install and weld the hundreds of feet of heavy-walled main steam lines that keep steam flowing to the turbines, as well as much of the auxiliary piping.

Through Kellogg's metallurgical background and the company's development of special field-welding techniques, the security of Kellogg K-Welds® on stainless, chrome-moly, and high quality carbon steel piping is assured for the life of the steam generating system.

Kellogg's role in the erection of one major utility's newest power station is fully described in the 12-page booklet—"The Eddystone Story." Inquiries for this booklet are invited from consulting engineers, engineers of power generating companies, and manufacturers of boilers, turbines, and allied equipment.

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WESTING

introduces POWER

. . . 1. a plan to predict future system needs accurately
. . . 2. a program of product development for generation, transmission and distribution geared to the needs of future systems

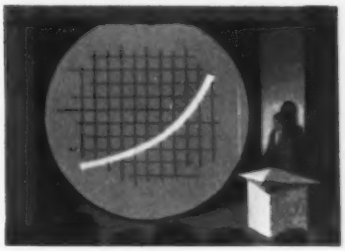
Pushbutton living for millions of people can bring a 10-fold increase in residential power consumption in 20 years. Commercial power loads will double in 10 years. An electrified industry means a massive increase to a rate of 667 billion kilowatthours in 10 years.

The most critical question facing you today

What is the best expansion pattern for your system? If the answer is right, you'll be able to determine capital investment more precisely than ever before, reaping great savings in planning, overhead, equipment and operation.

HOUSE CASTING*

LOADS OF THE FUTURE... BIG! In January, 1959, 426 top electric utility executives gathered at the Westinghouse Fourth Future Power Market Forum to preview electrical requirements for 5, 10, 20 years into the future. Read this message of the 4th Forum on the following pages.



Loads are growing fast

Spectacular growth in utility loads in the 1960's and 1970's is certain. Exploding population means 32 million more people to serve by 1969. Over one and a quarter trillion kilowatthours is the projected power market. To produce energy on this scale will require a generating capacity of 295 million kilowatts . . . more than twice today's capacity. How can this be achieved at an optimum return on invested capital?

Power systems are becoming more complex

A simple list of questions spells out the magnitude of expansion planning for any utility: When will new capacity be needed? What type of unit—coal, hydro, nuclear? What size—100, 200, 300 or even 800 mw? The heat rate? A new site? A developed site? And what about reliability? Transmission at 345 kv or 690 kv? Will distribution voltages double?

Today, each question is more complex than it was yesterday. Together, they present a formidable barrier to the success of conventional system planning methods. And tomorrow . . . in the era of the superload . . . power systems will grow and become even more complex. New long-range planning methods are not only desirable, but mandatory.

There is a way to plan your system for the next 20 years

Westinghouse has developed a basically new technique of total system planning. This method is Powercasting. Powercasting offers you a way to create a master plan for system expansion, together with total capital requirements, projected for the next 20 years.

Westinghouse Powercasting . . . a two-fold plan of action

1. Westinghouse Powercasting will predict your future system needs comprehensively and with scientific accuracy. This planning method is unique, because it takes into full account not only known and predictable factors, but unknown and chance considerations.

2. Based on a program of product development, Westinghouse will project and recommend future equipment investment, geared to the power demand predicted for your system, and keyed to your master plan of expansion.

Early and accurate prediction of future equipment needs will enable you to save substantially on purchases, because you will order the right equipment at the right time . . . eliminate premature or late buying. Greater flexibility in over-all planning means you can enter money markets for needed capital at the most advantageous times.

Powercasting is at work now

A complete system study is currently under way with Public Service Electric and Gas Company. A mathematical model of the system has been built, and a new plan of expansion is now being evaluated. Powercasting makes it possible to consider simultaneously more of the factors which influence system expansion.

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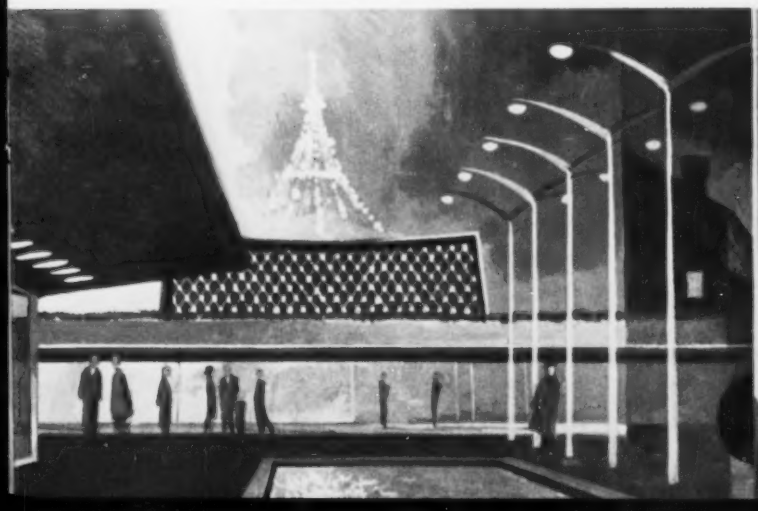
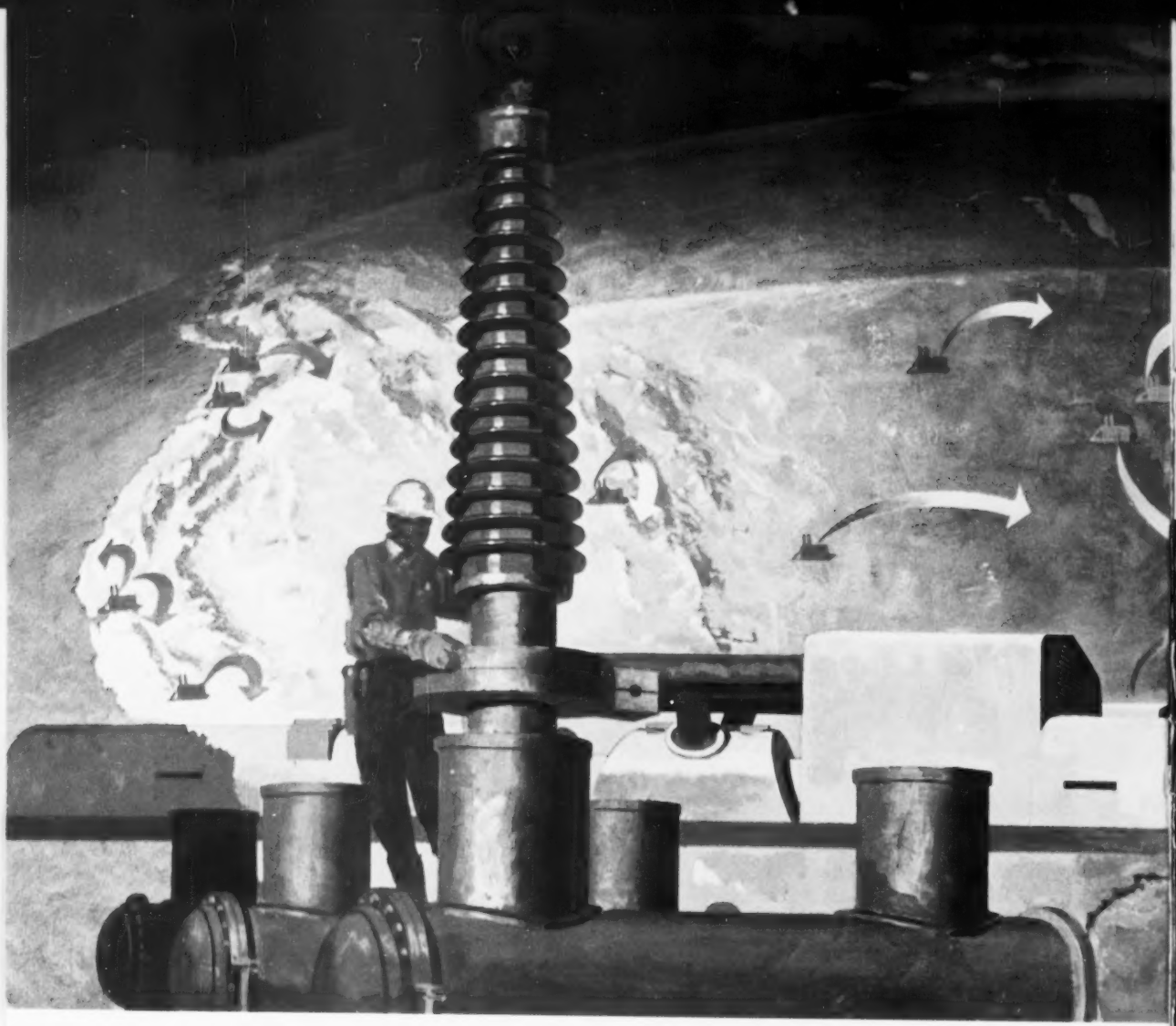
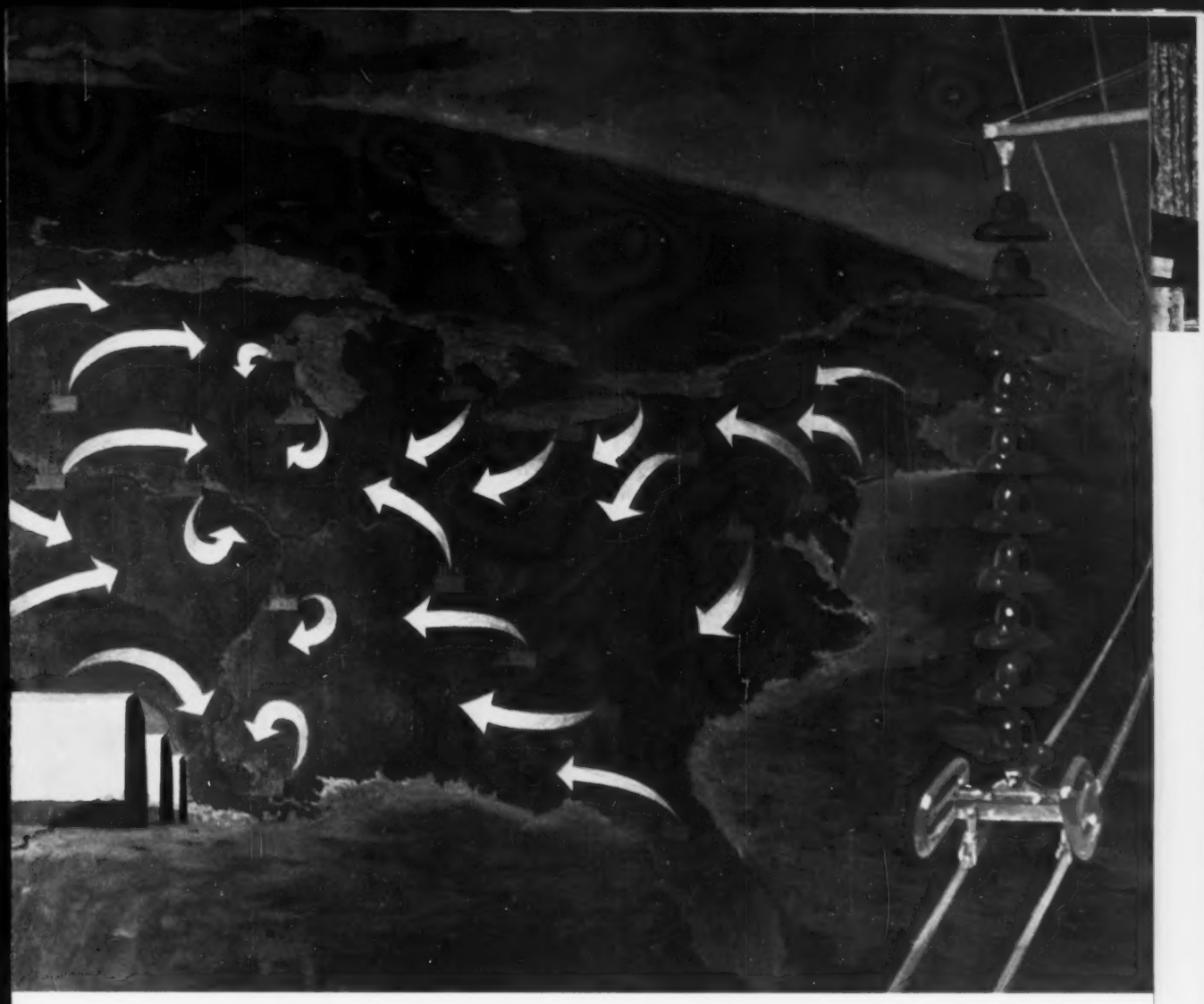
YOU CAN BE SURE... IF IT'S Westinghouse





WESTINGHOUSE POWERCASTING

can help you plan your system expansion economically...and now



Over the next 20 years, the electric utility industry will make a system investment of approximately 150 billion dollars. The resulting capacity would be enough to serve the entire world today . . . perhaps even two worlds. Growth on such a scale demands planning of a quality never before achieved . . . to realize investment and operating economies, to improve reliability, to increase customer acceptance.

. . . to produce larger blocks of power—300, 400, 800 mw

Tomorrow's supersystem implies generation of larger increments of power, even now an inescapable policy for many utilities. Larger, more reliable turbine-generators put into service will require stiffer internal ties for emergency conditions.

. . . to transmit at higher voltages—690 kv and beyond

Moving future bulk power from station to load center will be impossible at today's transmission voltages. In many areas, limited rights of way have already dictated higher voltages. On large systems, extra-high voltages will be the only answer in serving congested areas. Single circuits will carry the millions of kilowatts that half a dozen lines transmit today. The economies of EHV are becoming increasingly apparent; as the voltage goes up, the cost of kilowatt capacity comes down. Transmission lines of the future will be rated above 230 kv . . . at 345 kv . . . to 690kv, and most certainly beyond.

. . . to interconnect with neighboring systems

Peak load demands loom large as a problem in the fast-coming era of the superload. However, there is a way of handling system peaks, and at the same time reducing your generating capacity . . . broad-scale system interconnection. Interconnection will allow power distribution that follows the sun, and a sharing of capacity with neighboring systems. This method of operation will entail exchange of thousands of kilowatts, all at extra-high voltages.

. . . to distribute at doubled voltages

To distribute big loads economically, major system modernization is a must. Higher voltage is one measure that can bring you substantial operating and investment economies.

These are major trends evident today that will be typical of systems of tomorrow. To bring these systems into being demands the closest kind of coordination between system engineering and equipment design and application. The one method available to you today to do this job . . . to do it thoroughly and with scientific accuracy . . . is Westinghouse Powercasting. A description of Powercasting in action follows.

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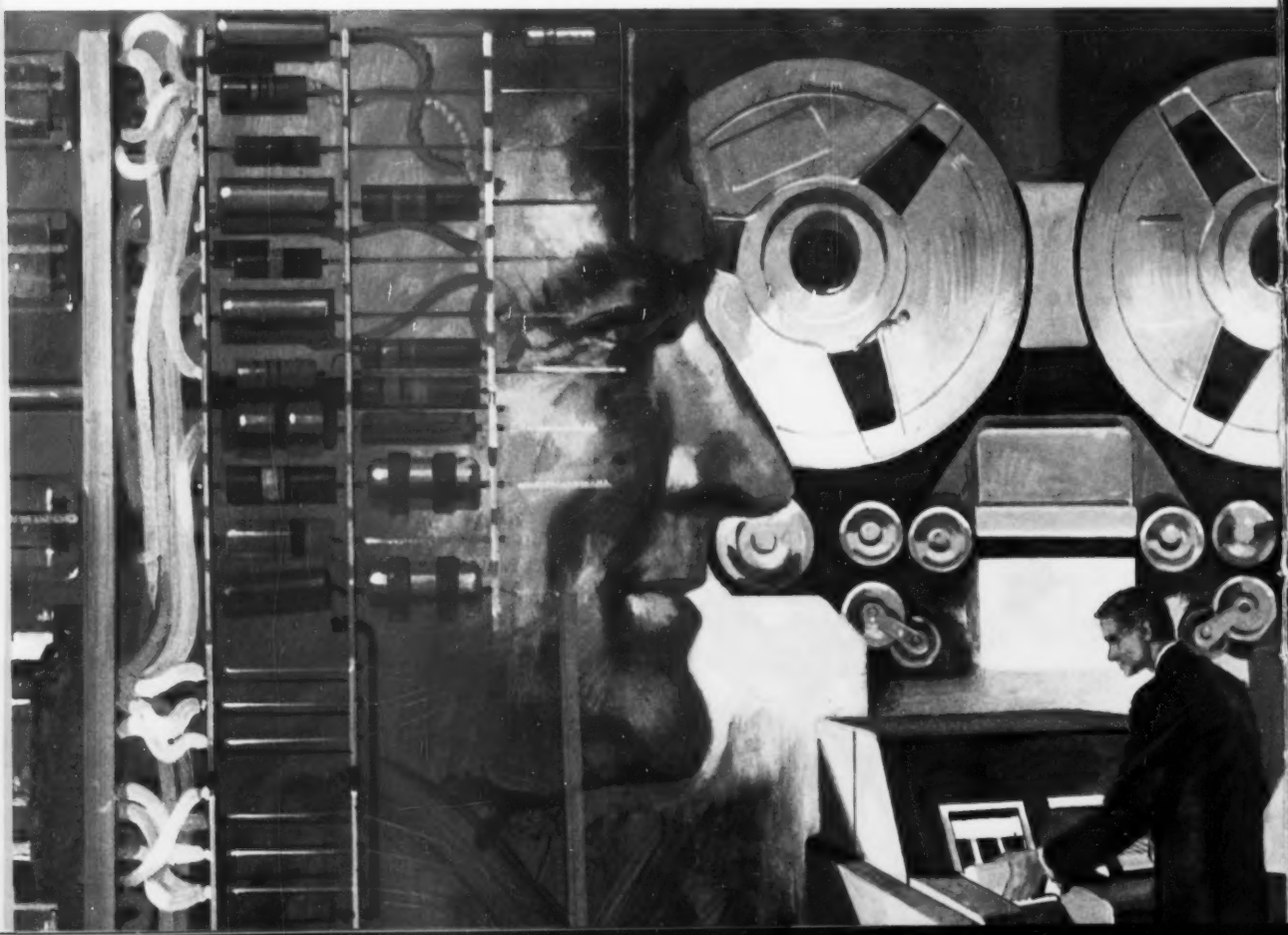
WESTINGHOUSE POWERCASTING*

. . . can help management anticipate the problems, make the right decisions



The superload and the supersystem mean an era of increasing capital investment, accompanied by increasing carrying charges and production costs.

It is increasingly apparent that cost-reducing product improvements and technological advances are no longer sufficient to meet the onslaught of inflation. Drastically new equipment application ideas are indicated. Fundamental changes in system planning methods are the only way out of the revenue-profit squeeze.

Costly errors in planning can be avoided

The decisions you make today are those you will have to live with for years to come. Moreover, each commitment sets up a chain reaction to exert widespread areas of influence on the whole future of a utility company. Errors in planning can be costly and practically irremediable.

Westinghouse can now offer the electric utility industry a new system expansion planning method . . . Powercasting. This method is both timely and comprehensive. Timely, because it has been created with the future character of the industry in mind—the 1960's and beyond. Comprehensive, because it takes into account not only present standards and known factors, but chance and unknown factors such as forecast error and forced outage.

Powercasting: first, a planning method — system simulation

Simulation—or Operational Gaming—involves a complete mathematical model of a utility's system and of adjoining interconnected systems. The model duplicates an actual utility system—responds to the same factors, produces the same results as the actual system. To operate this model system, a staggering array of variables, both predictable and unpredictable, have been taken into account. In the latter category, use is made of the newest mathematical techniques of gaming—Monte Carlo, autoregressive series, Markov chains, and other methods.

20 years' system experience in 20 minutes

In 20 minutes, a high speed digital computer can reproduce 20 years of system experience on a mathematical model. Day by day, the model determines what units must be run to supply the load; it starts up these units, accepts forced outages, maintains the units, computes risk of losing loads, adds generating units and interconnections, builds transmission facilities as required. The model uses the same logic to make decisions as do system planners and operators, deliberately makes the same mistakes as the operators do. Distributions and random variations used are based on the past behavior of actual systems. Human decisions are balanced against these random events.

At the end of the 20-year experience, the computer records all decisions made—dates when additions should be made, present worth of all expenditures, total capital needs, production and operating costs.

*A Service-Mark of Westinghouse

YOU CAN BE SURE...IF IT'S Westinghouse

WESTINGHOUSE POWERCASTING*

...already at work for Public Service Electric and Gas

Project keyed to sound financial plan and projected service standards

What is the best plan to expand system generation and transmission in meeting growing loads? This is the question Public Service Electric and Gas Company asked Westinghouse to help answer in a new and better way. The unprecedented joint study which has resulted is well on the way to an answer to this question.

It was obvious at the outset that this study was so broad and complex that groups of specialized talents, working simultaneously on all phases of the project, were essential in undertaking the problem. Seven groups of engineers, composed of personnel from both the Westinghouse Electric Utility Engineering Department and Public Service, formed a coordinated team. These groups have studied these areas: load forecasts, unit requirements, risk of shortage, transmission plans, production costs, capital costs, present worth economics. The results of these investigations were integrated into a single plan for evaluating alternate expansion patterns.

Progress report . . . a mathematical model has been built

From the system model "built" for Public Service, a plan of expansion is being evolved and evaluated. Flow charts have been laid out that describe a system planner's thought processes as he lays out new high-voltage transmission. Other charts trace the system operator's thinking as he plans maintenance schedules. Still others relate Public Service's experiences with those of the Pennsylvania-New Jersey-Maryland Interconnection. Past generator outage records are yielding new information through new methods of analysis. Customer service standards, together with frequency and duration of service loss, in terms of generating capacity additions, are being reappraised.

. . . through Powercasting, a master plan of expansion is emerging

This is but a fraction of the areas in which results are anticipated. A master plan is being evolved considering these and other questions:

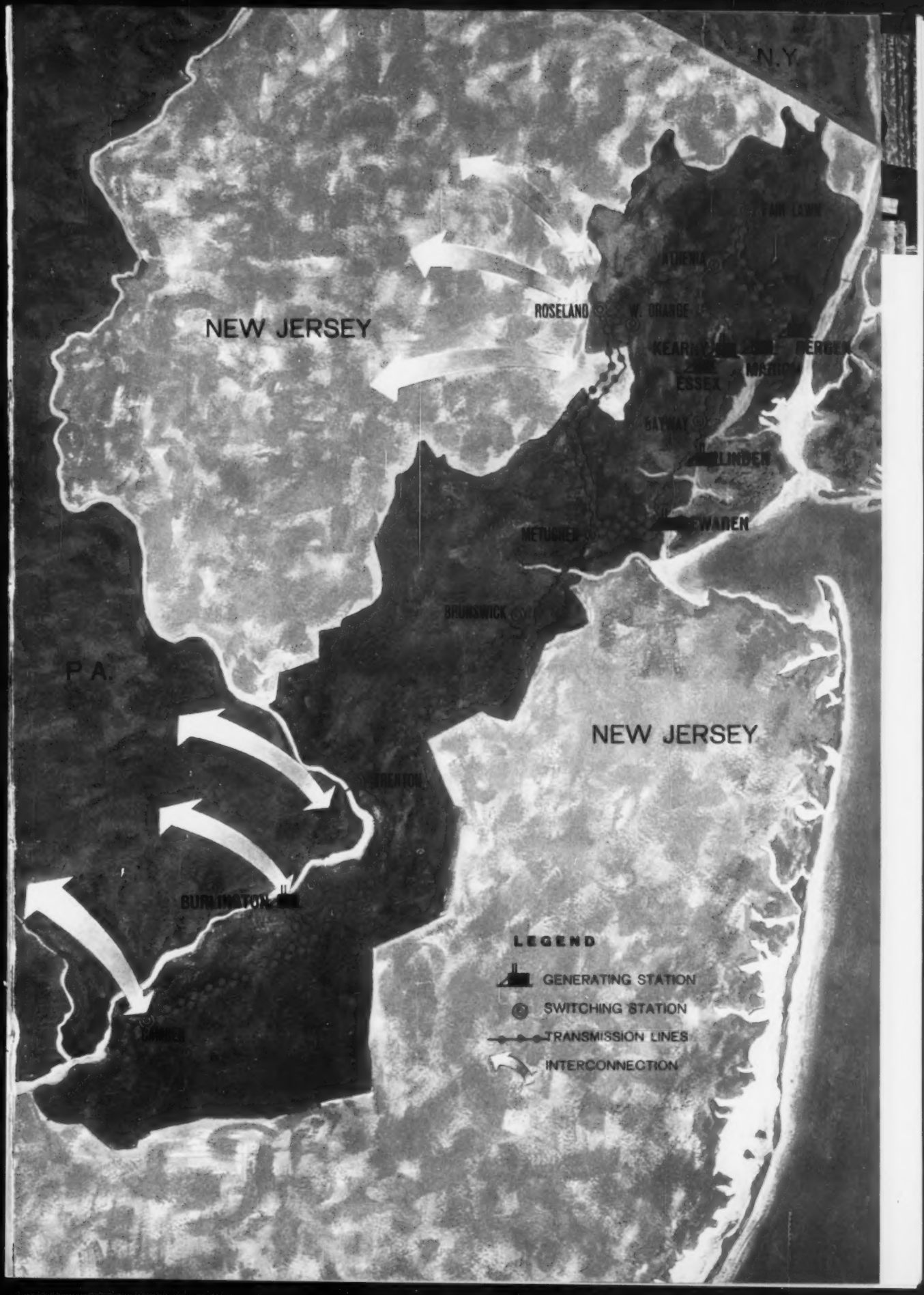
1. How much are further improvements in heat rate worth?
2. When will nuclear plants become competitive with fossil fuel on a specific system?
3. When is the retirement of old turbines justified?
4. How much can a utility spend for reliability?
5. Should a utility install gas turbine, pumped storage or steam peaking units?
6. What is the optimum spinning-reserve policy?
7. How will larger and larger units affect the reserve requirements of a system?
8. What is the effect of annual costs of possible future developments on the cost of the initial step in an expansion pattern?

Two factors will make this Public Service plan one of the century's most significant developments in the electric utility industry. First, the pattern of expansion itself will be far more accurate than any long-range pattern planned by conventional methods. Secondly, many more of the complex technical, financial, and human factors involved in the utilities' future expansion problems can be included in the study.

Powercasting is available to you now, because for years Westinghouse has plowed earnings into research to insure the future of the electric utility industry.

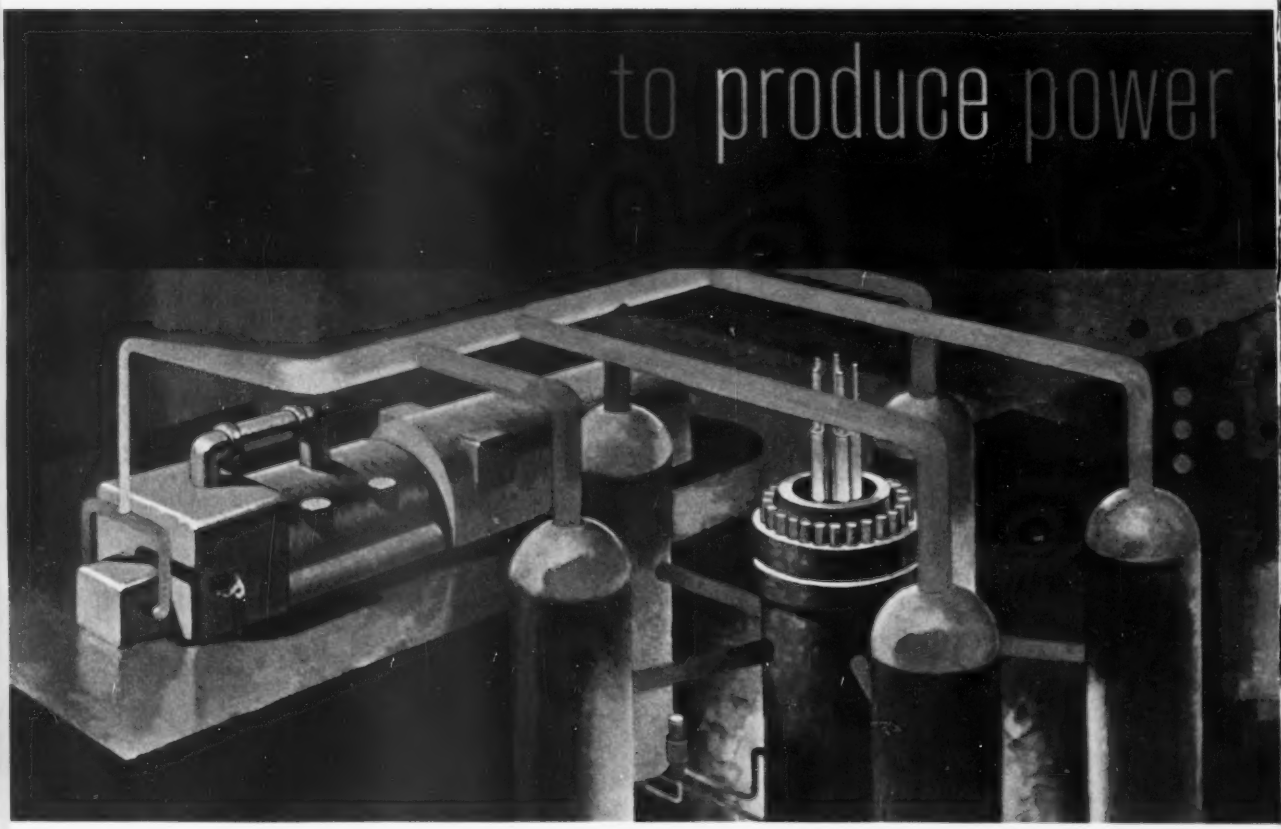
*A Service Mark of Westinghouse

YOU CAN BE SURE...IF IT'S Westinghouse


N.Y.
NEW JERSEY
ROSELAND
W. ORANGE
ESSEX
BAYWAY
LINDEN
METUCHEN
BRUNSWICK
P.A.
NEW JERSEY
BURLINGTON
LEGEND
GENERATING STATION
SWITCHING STATION
TRANSMISSION LINES
INTERCONNECTION

WESTINGHOUSE POWERCASTING®

is ready today to build products



Westinghouse is now ready to build a 330,000-kw nuclear power plant

Westinghouse offers this nuclear generating station for service on your system in 1965. This plant will compare in capacity with the largest fossil fuel plants required to meet present standards of economical generation. Power cost? Competitive with fossil-fueled plants in some areas of the country today.

Through comprehensive evaluation of dozens of possible reactor designs, Westinghouse has concluded that no one nuclear power plant is ideal for all times, or every utility power need. The most promising reactor types are currently under intensive development. For generating stations of the size now being added to utility systems, the pressurized water reactor is the only nuclear plant sufficiently advanced and proved to be offered for immediate construction.

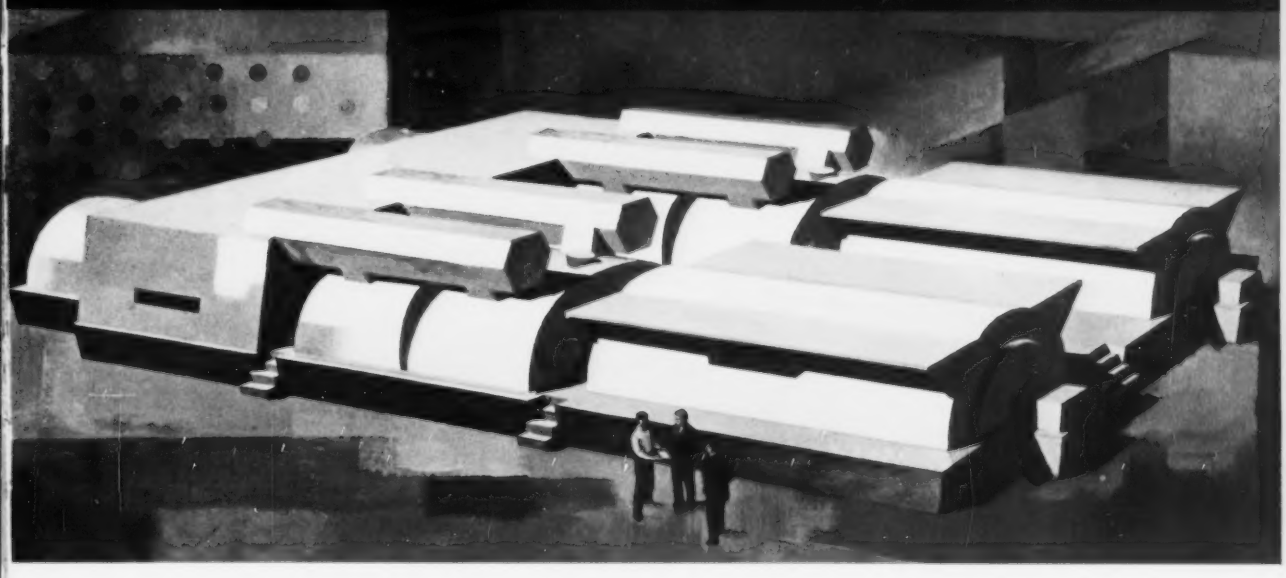
This plant is a result of the $40 million nuclear power investment by Westinghouse to make world-wide power generation from the atom practical, thoroughly economical.

Westinghouse is ready to build unprecedented 800,000-kw turbine-generator now . . . almost twice the capacity of the world's largest today

From Westinghouse research has come a new 28-in. exhaust end blade capable of 25 percent more power than any that have preceded it. Cross-compounding with four exhausts on each of two 3600-rpm shafts, this blade makes possible an 800,000-kw turbine-generator unit. Here is tomorrow's turbine-generator to supply massive amounts of low-cost, dependable

for your future system

Experience to understand total system operation . . . For decades, a special staff of engineers at the Westinghouse Electric Utility Engineering Department has been applying a bold mixture of technical knowledge and imaginative thinking to broad system problems. From long-range studies, basic concepts of power systems of tomorrow are being created. This capability can be put to work for you as . . . POWERCASTING.



electric power to a growing American economy.

Another turbine-generator of tomorrow has already been produced by Westinghouse. The highest pressure, highest temperature turbine ever undertaken is the 1200° F, 5000-psi unit for the Eddystone Plant of the Philadelphia Electric Company. Because temperatures in this range are beyond the capability of ferritic materials, this turbine uses austenitic alloys. Over-all station heat rate will be about 8100 Btu per kwhr—the most efficient in the world. This machine will produce 10 percent more power from the same amount of fuel than any now in operation.

Efforts to wring more and more power out of a pound of coal do not end with these giants. A combined gas-steam plant is coming. The same combustion source provides steam for the steam turbine and heat for the gas turbine. Result? Higher thermal efficiency.

With two outstanding breakthroughs, Thermalastic* insulation and Inner Cooling, Westinghouse generators have kept—even exceeded—the pace of power generation needs. A 384,000-kva generator is being built; even higher ratings are in the offing. Generators can be built now to match any turbine that can be built, any system plan that can be devised.

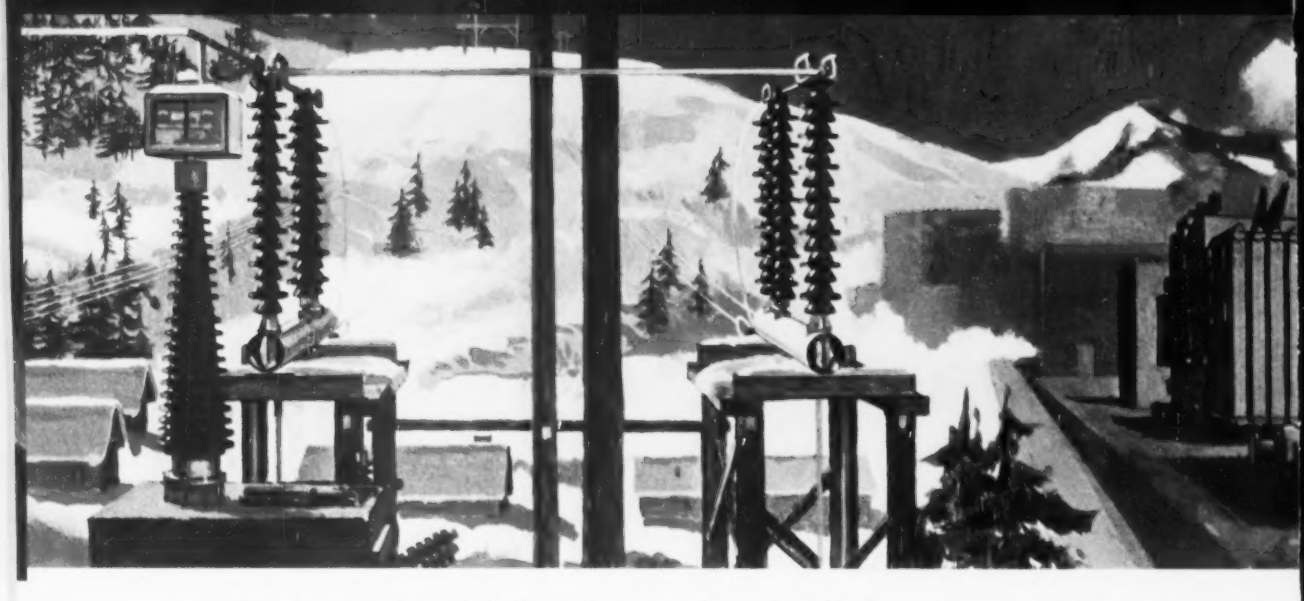
This generating equipment can be built now, because for years Westinghouse has plowed earnings into research to insure the future of the electric utility industry.

*A Service Mark of Westinghouse

YOU CAN BE SURE...IF IT'S Westinghouse

WESTINGHOUSE POWERCASTING

is ready today to build products to transmit power



Westinghouse is ready now to build power transformers for 690-kv systems

The great hinge on which the design of transformers of the future swings is extra-high voltage. The Tidd project of the American Electric Power Company, begun 13 years ago, proved that EHV transmission at 345 kv, 460 kv and above was practical and dependable. All operating conditions that could be expected were simulated. Today, transformers, power breakers, arresters and disconnect switches operate at extra-high voltages successfully on hundreds of miles of utility system circuits.

Three years ago, a laboratory of rocks and snow, the Rockies, began yielding a wealth of data for design and operation under extremes of weather and high altitudes, furthering EHV studies. Sponsored by the Public Service Company of Colorado at Leadville, Colorado, this broad investigation of corona and radio influence, switching surges, conductor sizes, reduced insulation levels and economics of EHV is continuing.

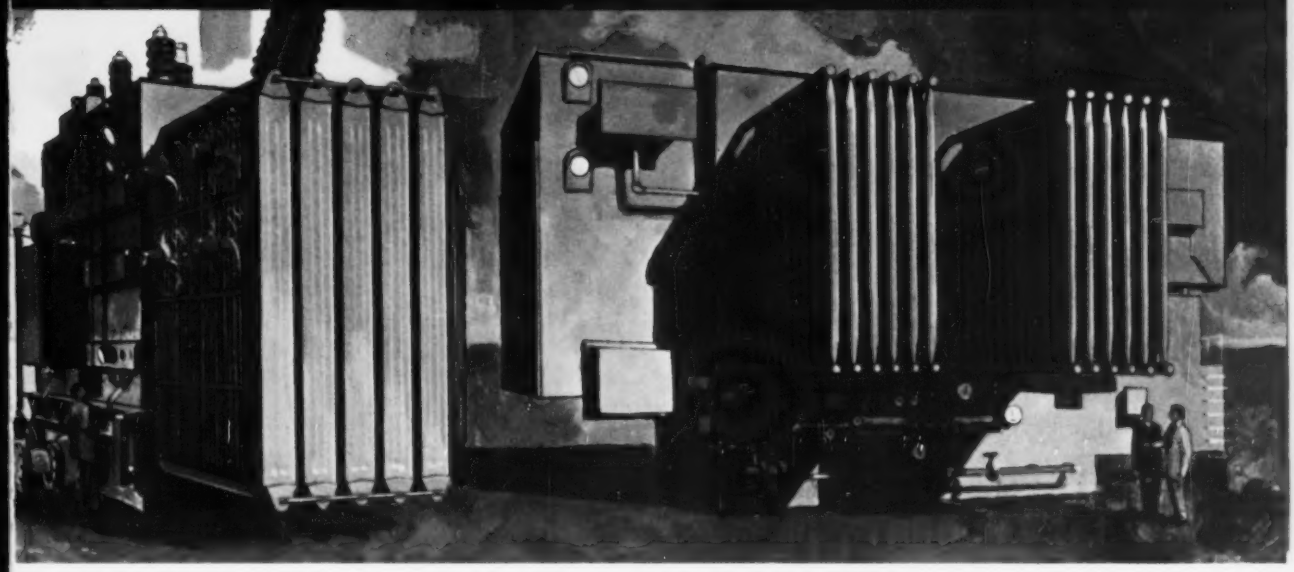
The Tidd and Leadville projects and other studies are the building blocks of EHV knowledge, making possible the design and application of the transmission equipment in your future.

Inner-Cooled transformers . . . reduced size and weight

Inner Cooling makes maximum use of oil as coolant and cellulose material as insulation, drastically reducing core and coil size. The significance of this design lies in two major areas. First, Inner Cooling now enables Westinghouse to build and ship transformers of enormous capacity. The world's first transformer

for your future system

Determination and resourcefulness to design the industry's most advanced line of apparatus . . . New Westinghouse products answer problems and objectives confronting the electric utility industry. At 200 research and design centers across Westinghouse, the industry's most concerted and interrelated effort to meet these objectives is continuing. This capability can be put to work for you as . . . POWERCASTING.



with Inner-Cooled construction was recently installed at New York State Electric & Gas Company, weighing only 3.1 pounds per kva. On higher voltage designs, weight has been brought down to 1 pound per kva.

Second, operating cost per kva is now lower than ever before. Performance has improved, permitting reduction of impedances and losses.

These compelling reasons commend the Inner-Cooled Westinghouse design for the transformer of the future.

Vapor-cooled transformers . . . combine dry-type safety with liquid-filled capacity and insulation level

Vapor-cooled, vapor gas-insulated transformers are another major breakthrough in Westinghouse power transformer design. This technique uses fluorocarbons to transfer heat . . . as a vaporizable liquid for cooling and as a high-dielectric gas to insure proper insulation strength. Two such transformers—the world's first, at Baltimore Gas & Electric Company and Consolidated Edison Company—are now in service and promise to be the ultimate answer in congested areas. They're nontoxic, nonexplosive, fireproof, thermally stable; in brief—they are safer.

This transmission equipment can be built now, because for years Westinghouse has plowed earnings into research to insure the future of the electric utility industry.

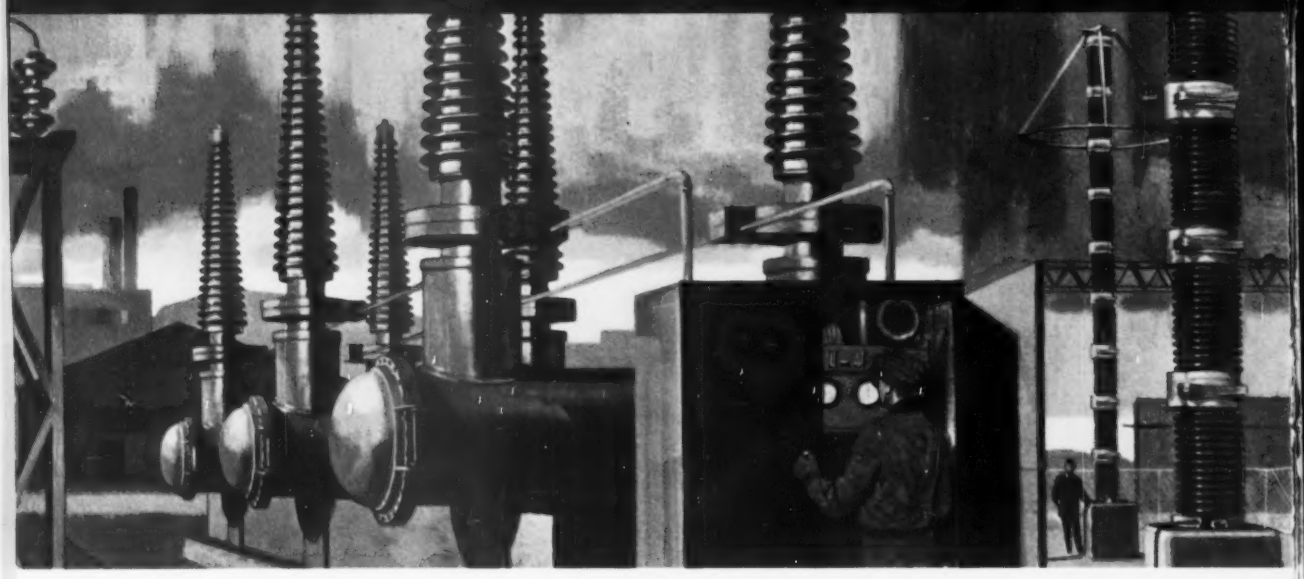
*A Service Mark of Westinghouse

YOU CAN BE SURE...IF IT'S Westinghouse

WESTINGHOUSE POWERCASTING*

is ready today to build products

to distribute power



Westinghouse is ready now to build 690-kv power breakers . . . SF_6 Gas is breakthrough to conquest of the industry's costliest arc extinguishing problems

Sulfur Hexafluoride—SF_6 Gas—is the interrupting medium for a 230-kv, 15 million-kva power circuit breaker now being built for Pennsylvania Power and Light Company. What are the limits to capacity of the SF_6 breaker principles? There are none.

Capacity is only one measure of the most significant breaker design advance in over 15 years. Safety? SF_6 is inert, nontoxic, odorless, nonflammable; breaker is dead tank construction. Maintenance? Drastically cut; arcs are extinguished without gas deterioration. Weight? Reduced up to 65 percent over comparable oil breaker ratings; foundations can be simplified. Quiet? Comparable to oil breakers; ideally suited for those substations in high load density residential areas.

Here is one more example of how Westinghouse has spent millions in product designs to save utilities tens of millions in future construction and operation.

Westinghouse is ready now to build lightning arresters at and above 690 kv

The idea of a nationwide transmission grid highlights two needs immediately . . . extra-high voltage transmission and standards of reliability never before achieved. EHV will be required to move large blocks of power economically. But, a basic problem in EHV reliability has been lightning outage. Application of a completely new theory of lightning stroke now promises to reduce lightning flashover by three to one. Effects of lightning on different designs of transmission line can now be predicted with far greater

for your future system

Capability to produce the industry's most complete line of reliable apparatus . . . With utility industry progress at a dead run, a responsible manufacturer can do nothing less than provide equipment as operationally perfect as manufacturing science can produce. Westinghouse ability to continue to meet this challenge is evidenced by facilities being built and modernized throughout the company at the rate of 70 million dollars a year. This capability can be put to work for you as . . . POWERCASTING.

accuracy. Increased line reliability must be matched by improved protection of equipment. Westinghouse is ready now to build arresters to meet the obligation of reliable, economical transmission . . . to 690 kv.

You can reduce distribution investment 25% by doubling secondary voltages

Apparatus investment in distribution systems is well over a billion dollars annually. An opportunity to save hundreds of millions of such an amount can scarcely be overlooked.

For example, in a high-use residential area, a 37 1/2-kva transformer may serve four homes. In new housing developments, by changing over to 240/480-volt service, one transformer can do the work of four or five. With higher secondary voltages, primary voltages may be raised to 25 kv or even higher. This eliminates present intermediate voltage levels and need for substation transformation.

Average industry installation costs and capitalization rates indicate higher secondary voltage systems will save substantially through the years over present conventional systems.

Westinghouse is ready now to build pole-type transformers at 333 kva for commercial loads.

This equipment of the future can be built now, because for years Westinghouse has plowed earnings into research to insure the future of the electric utility industry.

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Powercasting is intended to increase the cooperation, coordination and total effectiveness of utility companies, their consulting engineers and Westinghouse in long-range planning. Westinghouse intends through Powercasting to reduce utilities' total expenditures for overhead, planning and equipment over a time span of at least 20 years.

here's how WESTINGHOUSE POWERCASTING* can be put to work for you

WESTINGHOUSE WILL . . .

. . . Send a qualified Powercasting Team to your office.

. . . Help you outline problems and objectives for your particular system.

. . . Arrange a special seminar to detail the project specifications.

. . . Build a mathematical model of your complete system.

. . . Predict your future system needs comprehensively, accurately.

. . . Program your equipment investment and gear it to the power demands of your system.

Only Westinghouse offers this Powercasting Service, a continuous plan of action for stable growth in the electric utility industry.

*A Service Mark of Westinghouse CP-1054

YOU CAN BE SURE...IF IT'S Westinghouse

WATCH WESTINGHOUSE PRESENTS THE BELL TELEPHONE HOUR CBS TV FRIDAYS

Sociabilities after sessions gave opportunities for "woodshedding" sessions like the one pictured at left. At right, the five sponsors of the conference divisions. Seated, from left, are E. F. Beatie, Southern California Gas; John Peebles, Southern Counties Gas; and Bill Ismay, Arizona Public Service Co. Standing are Robert R. Hatch, left, San Diego G&E; and Roger Barbey, PG and E

PCEA-PCGA Discuss Responsibility

"Our Responsibility for the Coming Decade" was the intriguing theme for an Administrative Services Conference of the Pacific Coast Electrical Assn. and Pacific Coast Gas Assn. in Palo Alto in mid-November.

The keynote speaker was Walter Lucking, president of Arizona Public Service Co., who discussed a thought-provoking, human side of utility economics.

"As a utility president," he said, "the most important problem I have is: what kind of people will we have in our company 10 years from now?"

He said that individual capacity in the setting of democracy can hold the economy. Just as this is true, managers within the utility companies must have economic responsibility that is far broader than personal gain, and they must prove their ability by achieving solid utility economics.

Lucking said there is a need for 19th Century-type entrepreneurs in the utility business today. "Each of us can be entrepreneurs. The opportunities are here, today, in our own industry. We know there will be change, and that there are decisions to be made."

Discussions in all five of the different sections of the conference were lively and a great deal of information was exchanged. Of particular note is the increase in size of the Purchasing and Stores Section, which has probably grown more than any other in the joint group in the past five years.

This ELECTRICAL WEST report of the conference will deal with those papers presented that are most closely related to the keynote address. Proceedings of the technical discussions will be available later from PCEA and PCGA.

Bill Ismay, industrial relations manager, Arizona Public Service Co., repeated a quotation from a PCEA Fall Meeting in Fresno made 11 years ago to help set the tone of the conference. It was:

"Andrew Carnegie, the great railroad builder and steel man, proclaimed that railroads were made up of 95% man and 5% iron. More modern students of our industrial scene have reached this conclusion 'that business assets are 85% human, 10% materials and equipment, and 5% financial.'"

The speaker of 11 years ago then said that business management has not generally recognized the weight of the "people" factor in business; it knows little about the potential of individual employees; it has done a poor job at releasing that potential.

Questioned Ismay: "I wonder today how much this man's challenge stirred those who heard it?

"In the decade that has passed since then, every company represented by the men here today has experienced tremendous growth. We have added millions of customers. Our capital investment has skyrocketed. Our construction and operating budgets have become astronomical. Our employee rosters have doubled and tripled in some cases. Yet it is a safe bet that in most of our companies, the attention paid to and the money spent for 'man maintenance' lags far behind that for any other phase of our business."

Taking the subject of personnel development, J. H. Westbrook, director of personnel of West Penn Power Co., offered seven steps that might prove helpful.

The first was to identify the development needs for an individual company. This involves taking an

Officers are shown with Dr. E. Dwight Barnett, Stanford Medical Center, center. From left are W. E. Johns, PG and E, vice-chairman; C. W. DeVoe, SDG&E, co-chairman; Barnett; R. W. White, PG and E, co-chairman; and W. T. Quinsler, APS, vice-chairman

inventory of the capacity of present personnel within the company organization.

The second step is to look ahead to evaluate, if possible, the needs of the organization in five, ten, or even possibly more years in the future. At this time, at least a tentative decision is made on what the organization structure will be at various stages of the future.

No. 3 in the series is to develop an inventory of the specific development needs of individual people in the company to fit the organization of the future. He pointed out that it will be found that the needs of various people vary tremendously, and that training through packaged programs is not likely to be the long-term answer to problems.

The fourth step suggested by Westbrook is the appraisal of the "climate" in the company to determine whether or not there exists an atmosphere in which people are encouraged to grow and develop. If a poor "climate" is found, then it is probably time for creating "position descriptions" that permit the maximum exercise of initiative and decision-making in each position. It involves establishing an organization structure that permits the full utilization of the various specialties necessary for the maximum performance of the operating job. It also involves the encouragement of a free flow of information between all levels of the organization and across departmental lines.

The fifth step is the preparation of specific development activities planned for each of the people in the organization.

No. 6—the one that sends everybody to the aspirin bottle—is implementing the program.

Finally, Westbrook said: ". . . you will need to set up a method whereby you can continuously check the progress of each individual in achieving the development plan which has been outlined by him and his boss. To the extent that these individual developmental plans are implemented and progress made, your company will be doing an effective personnel job."

Two areas of management performance standards were tossed out by Keith Turley, who is the organization development manager for Arizona Public Service Co., for discussion from the floor. First, he urged that performance standards should continue to be set in terms of moral strength, integrity, justice and conduct. Along with these standards, he said an appraisal system is needed that will help appraisers be more competent in judging the man.

His second discussion background was that performance standards are needed for each manager in terms of specific measurable results, in terms of dollars and cents, comparisons, trends, efficiencies, earnings, productivity increases, and all the other factors of work measurements. With these standards are needed measuring systems that will serve as instruments of self-control as well as being a basis for judgment.

The same conference theme will be pursued further at the next meeting of the two organizations on April 11-12 at the Huntington-Sheraton Hotel in Pasadena.

General Program

Development and Use of Manpower

Sponsor: William Ismay, Arizona Public Service Co.

Defining the Conference Objectives, Bill Ismay.
Supervisory and Management Performance Standards, Keith L. Turley, Arizona Public Service Co.
Employee Development—Management, Supervisory and Nonsupervisory, J. H. Westbrook, West Penn Power Co.
Improving Employee Communications, Olin H. Ririe, Utah Power & Light Co.
Round Table—Keith L. Turley, *Supervisory and Management Performance Standards*.
Round Table—J. H. Westbrook, *Employee Development—Management, Supervisory and Nonsupervisory*.
Round Table—Olin H. Ririe, *Improving Employee Communications*.

Purchasing and Stores

Sponsor: R. W. Barbey, PG and E.

How May We Improve on the Administration and Control of Low Value Purchases?

Purchasing and Stores Objectives, W. G. Johnson, PG and E.
Operating Department Viewpoint, S. C. Anderson, PG and E.
Accounting and Auditing Approach, H. S. Hemings, PG and E.

How May We Obtain the Necessary Lead Time?

Stores Viewpoint, R. L. Townsend, San Diego Gas & Electric Co.
Purchasing Attitude, L. C. Jantz, California Electric Power Co.
Value Analysis in the Next Decade, W. W. Tryon and J. A. Padovani, Columbia-Geneva Steel Division, U. S. Steel Corp.; D. K. Rose, Southern Pacific Co.
Let's Look at the Storekeeper's Job, D. M. Pritchett, California Pacific Utilities.

Plant Accounting

Sponsor: Robert R. Hatch, San Diego Gas & Electric Co.

How the Regulatory Classifications Influence Our Plant Accounting Procedures, E. O. Earland, Southern California Gas Co.
The Continuous Inventory System, Robert DeGeere, California Electric Power Co.
Plant Accounting as a Tool for Management, E. J. Lage, PG and E.
Is It Capital or Maintenance? Jon Hardway, San Diego Gas & Electric Co.
The Case for Standard Costs, W. T. Kyle, Southern California Edison Co.
Application to Mass Property Accounts, W. J. Franklin, Southern California Edison Co.
An Integrated System Using Electronic Data Processing, Donald E. Nelson, Remington Rand Univac representative.

Disbursement and Pay Roll Accounting

Sponsor: John H. Peebles, Southern Counties Gas Co.

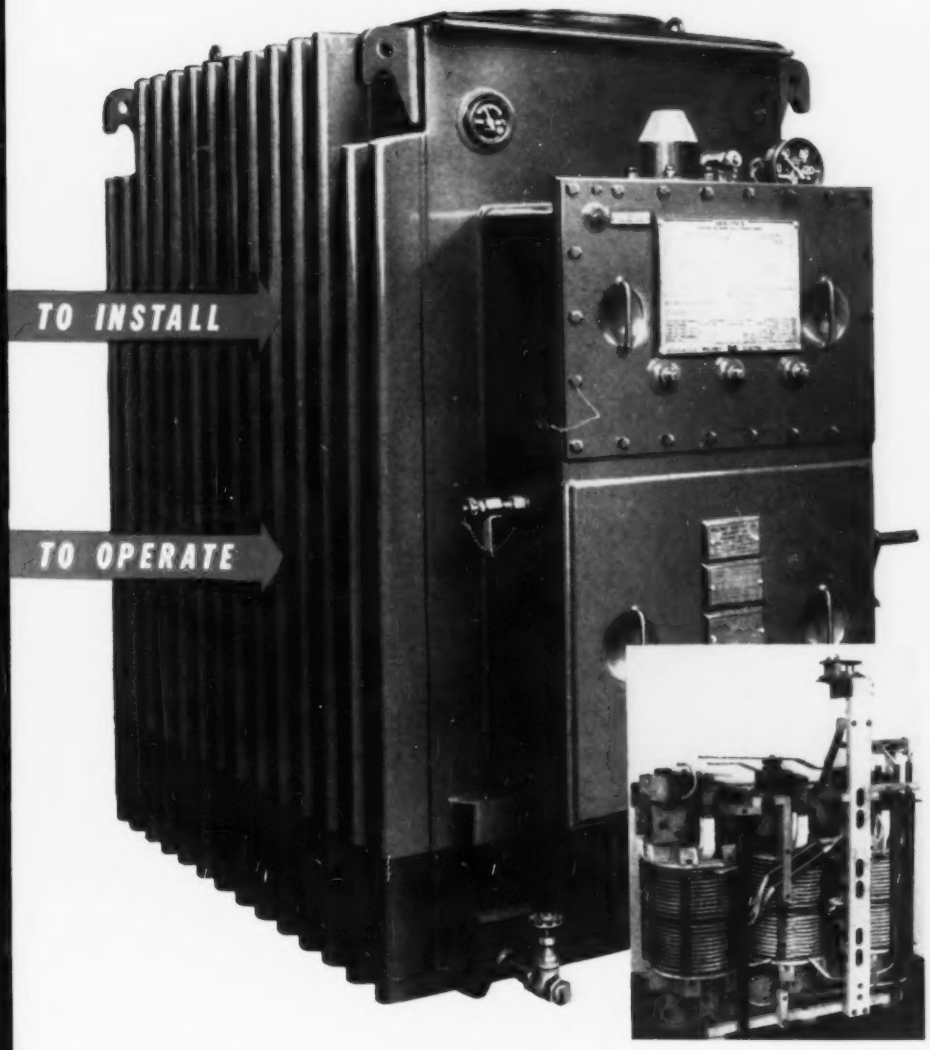
Operating Functions of the Accounts Payable Section and Its Responsibility for System-wide Control of Disbursements, Burney Warren, El Paso Natural Gas Co.
Procedures for Reviewing and Passing Accounts Payable Items for Payment, John Fay, Southern California Gas Co.
Mechanized Methods and Procedures for Processing Accounts Payable, L. W. Crosby, Southern California Edison Co.
Functions and Responsibilities of the Pay Roll Section, Arthur R. Mitchell, Cascade Natural Gas Corp.
Pay Roll Section Procedures for Preparing the Pay Roll, R. F. Parsley, San Diego Gas & Electric Co.
Application of Mechanized Methods to Pay Roll Procedures, L. D. Coughran, PG and E.

Economics of Credit

Sponsor: E. F. Beatie, Southern California Gas Co.

Economic Aspects in the Establishment of Credit for Residential Premises, Wayne Stone, PG and E.
What Are the Economic Characteristics of a Sound Deposit Program? T. M. Jackson, Southern California Edison Co.
The Utilization and Effects of Electronic Data Processing on Collection Follow-up, Jack W. Mott, Arizona Public Service Co.
A New Concept of Manpower Utilization for Field Collections—The Route Collector, W. M. Fisher, Southern California Gas Co.
Credit and Collection Indoctrination for Contact Personnel, Don A. Jackman, Southern Counties Gas Co.
What Are Basic Economics of Final Bill Collections? Paul N. Osborne, California Electric Power Co.

ECONOMICAL



BECAUSE:

1. Each tank side completely corrugated out of one piece of metal, requiring welds only at the corners.
2. No thinning of the metal occurs at corrugations.
3. The corrugations do not need sidewall bracing therefore, another possible source of corrosion is eliminated.
4. Tank is easily cleaned from above and there are no inaccessible areas to hinder painting.
5. The tank and handhole covers are welded in place to eliminate the possibility of leaks, however, bolted covers are available if required.
6. Network transformers with corrugated tanks are smaller in size than old style tube type tanks.
7. Reduced size allows installation of larger units in existing vaults.
8. Protection against corrosion is provided by undercoating the base and the lower portion of the tankwall.
9. The core, coil, leads, supporting members and framework are uniquely combined to give ample electrical clearance and to obtain a rugged unit that is exceptionally compact.
10. Low sound level means better customer relations.

Moloney Network Transformers are uniquely designed both inside and out to provide a superior unit for use on secondary network distribution systems. The corrugated tank coupled with a compact, rugged core and coil assembly having high overload capability, offers the potential user many reasons for purchasing Moloney Network Transformers.

These units are available in types conforming to EEI-NEMA Standards or in types especially designed to meet the requirements of your network system.

Specify Moloney Transformers for every application . . . All Along The Line.

ME59-10

MOLONEY ELECTRIC COMPANY

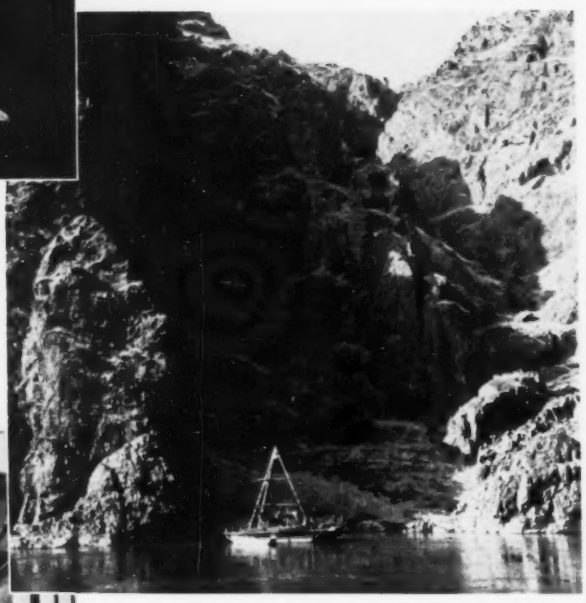
Transformers for Utilities, Industry and Electronic Applications

FACTORIES AT ST. LOUIS 20, MO., AND TORONTO, ONT., CANADA

Sales Offices in All Principal Cities

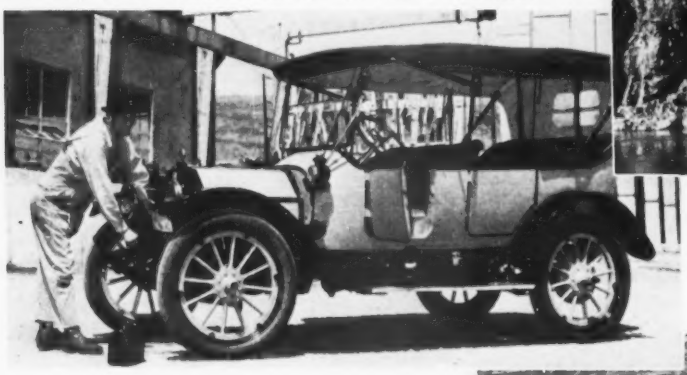
news

This runner for the largest earth-filled dam in the world at Fort Peck in northeastern Montana is shown being welded on the largest welding positioning table in the Western Hemisphere. It is being fabricated by Allis-Chalmers Mfg. Co. for the Corps of Engineers

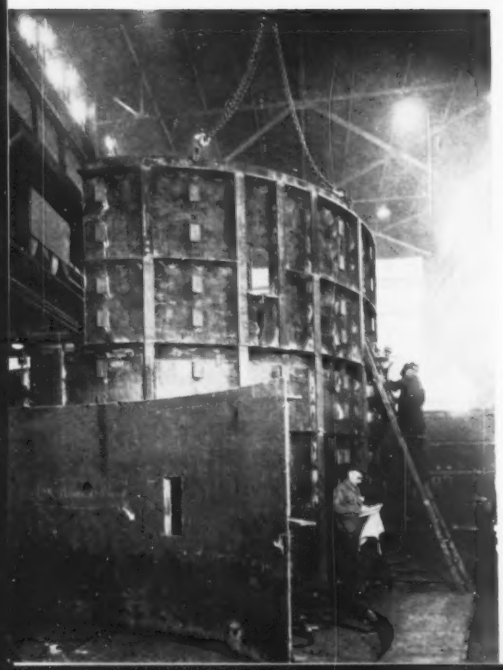


Core drilling at the site of High Mountain Sheep Dam of Pacific Northwest Power Co. was recently completed. Public power groups have tried to get a five-year moratorium on the project, ostensibly for high dam fish research

Frank G. Thompson cranks up a 1914 Buick on his last day at work for Pacific Power & Light Co. He started with PP&L at the time the car was a current model. Thompson started as a lineman and was at the Yakima service center at retirement



Chelan County PUD saved more than $2 million in construction of Rocky Reach Dam on the Columbia River by pumping grout into 1,081 holes drilled along this cut-off trench extending eastward from the river. When the grout hardened, it prevented Columbia River water from seeping through the east bank past the concrete abutment of the dam



Undergoing fabrication in Allis-Chalmers shops is this lower wheel pit liner assembly for the first of two 88,000-hp impulse hydraulic turbines for the Jaybird power house of Sacramento Municipal Utility District. Delivery to the power house, which is on the Upper American River, will be this coming spring

EW

Management

Middle Snake Stall

The four companies that make up Pacific Northwest Power Co. are fighting a proposed five-year moratorium on construction of dams in the middle Snake River area.

Kinsey M. Robinson, president of Washington Water Power Co. and chairman of the board of PNP, termed the proposal "intolerable" before a Senate Interstate Commerce subcommittee hearing at Lewiston, Idaho, in mid-November. The moratorium plan, offered by Sen. Warren G. Magnuson (D-Wash.) and backed by other Northwest senators, would delay construction of any new dams on the middle Snake between Lewiston and Hells Canyon until 1964 and would provide for a fisheries research program to study problems of fish passage over dams.

PNP is attempting to build a high Mountain Sheep dam above the mouth of the Salmon River but below the mouth of the Imnaha. Robinson called the moratorium plan an attempt to block construction of this project. REAs of the area are supporting the moratorium as well as the Northwest Public Power Assn. On record against it are the Chamber of Commerce and the Inland Empire Waterways Assn.

Contract Attacked

J. E. Corette, president and general manager of Montana Power Co., says he believes the attack on a power contract to serve Yellowstone Park was "merely a political move designed to embarrass the National Park Service, Department of the Interior and General Service Administration and at the same time criticize a taxpaying, investor-owned utility."

Attempting to make political hay by attacking the contract is Congressman John E. Moss (D-Calif.) who heads a House subcommittee that is investigating the contract.

As a result of the furor the Interior Department has announced it will reopen the contract. Two REA cooperatives had submitted lower bids for the service.

Corette says the charge that the REAs offered lower rates to the park than the company offered cannot be substantiated. He pointed out the Montana power plan and the REA proposals could not be compared because of the greater service and stronger lines proposed by the company.

Too Much Rain

Activities of a rain-making firm on behalf of a power company have led Gov. Albert Rosellini to order an investigation.

The Water Resources Development Corp. of Denver has been conducting cloud-seeding operations in southwest Washington for the Pacific Power & Light Co. to fill its hydroelectric reservoirs. The power company is satisfied with the results but farmers of the area blame farm losses on a surplus of rain.

Rosellini asked the State Weather Modification Board to study the matter before granting the Denver firm's request for a renewal of its license. A meteorologist for the rain-making firm has denied his company's operations were responsible for any farm damage.

► Members of the Hawaiian Public Utilities Commission are attempting to have eliminated from the Omnibus Government Reorganization Bill creation of a position called "hearings officer" to "hear and decide all cases of controversy or litigation regarding license, the application of rules and regulations and enforcements thereof, including the determination of rates with respect to public utilities." In effect, the PUC would then become an appeals board.

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Opinion Difference

Conflicting opinions on REA interest rates were voiced at the Region 9 convention of the National Rural Electric Cooperative Assn. at Lewiston, Idaho, in early November.

Clyde T. Ellis, general manager of the National Rural Electric Cooperative Assn., urged retention of the present REA interest rates.

But David Hamil, REA administrator, told delegates that the REA program was losing public support by insisting on borrowing rates below the going rate for money. He said there is no long-term financing program in the government today that offers borrowers such a low interest rate as the Rural Electrification Administration. He urged the co-ops to "stop worrying" that Washington is "out to ruin you."

Money Loser

The government-owned British Columbia Power Commission has laid off about 1,000 workers in the past 18 months following completion of its five-year development program. The figure is about half the commission's peak work force of 2,200.

Speaking at a meeting of the Kiwanis Club of Victoria, Lance Whittaker, public relations chief for the commission, said it operated at a loss of $250,000 for the first six months of this year and is headed for a loss of $500,000 for the full year.

► Northwest Public Power Assn. added to its staff Mrs. Edwin E. Edinger as research editor. For the past six years she had been publicity and public relations director for the First Presbyterian Church of Portland.

► Colorado Rural Electric Power Use Advisors Assn. was recently formed "for the purpose of exchanging educational ideals on all phases of rural electrification" and elected Ronald Wadleigh of San Luis Valley Electric Assn., Monte Vista, as president; Ev Chesney of Yampa Valley Electric Assn. of Steamboat Springs, vice-president; and Howard Pease of Mountain View Electric of Limon, secretary.

► Voters of the Grant County Public Utility District have approved a plan to increase the membership of the PUD board from three to five members. As a result, present commissioners will create two at-large commissioner districts and PUD commissioners will appoint a man for each district.

► The Tacoma Public Utility Board has decided to exclude foreign manufacturers from bidding on generators, transformers, switchgear and other heavy equipment required for the Mayfield Dam power house. The board accepted the recommendation of Tacoma City Light by a margin of only three to two.

► Officials of Nevada County (Calif.) Irrigation District and Pacific Gas and Electric Co. are holding talks in reference to a $52 million joint integrated power and irrigation development on the Yuba and Bear Rivers.

► A joint committee of the Southwest Washington PUD Assn. and the Eastern Washington PUD Commissioners Assn. has retained Claude Lester, former retail rate expert for Bonneville Power Administration and present staff member of Ruralite Services Inc., to conduct a study of PUD electric rate patterns, rules and regulations affecting residential and commercial customers. The study is the first step to standardization of PUD practices.

► Columbia Interstate Compact Commission predicts that a final draft of the proposed compact among seven Pacific Northwest states on water uses in the Columbia-Snake river systems would be ready next spring.

► At least electrical fires were not the top of the heap in the recent summary made by the National Fire Protection Assn. for 1958. First cause was defective or overheated cooking and heating equipment, second was careless smoking and electrically caused fires came third. Losses caused, however, by electrical fires topped the damage list with $183,499,000.

► Colorado Public Utilities Commission has employed David A. Kosh Associates Inc., Washington, D. C., to review Public Service Co. of Colorado's request for a higher return from its investment. The PUC said the Public Service application was too complicated and detailed to be handled by the regular PUC staff.

Growth

A steel skeleton weighing about 1,200 tons takes shape at British Columbia Electric Co.'s thermal electric generating station site on the north shore of Burrard Inlet near Vancouver. The power house is scheduled for completion this year. The first steam-driven generating unit in the building is scheduled to be in operation in 1961. A total of four 150,000-kw generators will be in operation by 1965

Distribution Study

Seattle City Light expects to complete a study next April on a comparison of 26-kv with 4,160-v distribution to determine if future extensions of its primary distribution system should be at 26 kv.

The study is being directed by Lyle Gleason, senior engineer in the system engineering section of the engineering division.

City Light presently runs 26-kv feeders from its six receiving substations to distribution substations located about one to each square mile of service area.

Under the plan being studied, the voltage would be reduced at the poles directly from 26 kv to 120-240 v.

New Unit Approved

Directors of the San Diego Gas & Electric Co. have authorized the design, purchase and construction of Unit 2 of the new South Bay power plant.

It will cost $15 million and have a generating capability of 142,000 kw, the same as Unit 1 which is presently under construction.

Addition of the two units will raise the total generating capacity of the company's four plants to 950,000 kw, a 40% increase over present capacity.

► U. S. Bureau of Reclamation has awarded contracts for equipment for the Upper and Lower Molina power plants on the Collbran project in western Colorado. Turbine contracts go to Allis-Chalmers Mfg. Co. with a bid of $232,921. The contract for generators was awarded to Elliot Co., a division of the Carrier Corp., for $264,825.

► Construction has begun on a 15-mile natural gas transmission pipeline to provide additional gas to San Diego Gas & Electric Co. On completion, the San Diego utility will be able to receive 142,000,000 cu ft of gas per day.

► Bids to complete construction of Mayfield Dam will be opened Jan. 5 by the city of Tacoma. Construction was halted last year.

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FIRST PVC RIGID CONDUIT INSPECTED AND PASSED BY UNDERWRITERS LABORATORIES!

Only KRALOY, yes *only* KRALOY, among all plastic conduits, now carries U-L listing—another first for KRALOY! High impact KRALOY PVC (Polyvinyl Chloride) RIGID CONDUIT... the *lifetime* conduit... the *perfect* conduit... won't rust, won't pit, won't corrode, won't support combustion, is non-magnetic and non-sparking. KRALOY needs no paint, no coating, needs no lining, and its mirror-smooth inside wall makes fishing easier than with any other type of conduit. Add these outstanding features to KRALOY's extreme light weight (see chart below) and you have the *ideal* conduit... ideal for direct burial and slab work. Installation costs can be cut *drastically* with light weight KRALOY PVC RIGID CONDUIT. Consider the dollars to be saved in handling and installing U-L listed KRALOY CONDUIT Cat. No. KE-1058 versus steel, *versus even aluminum conduit:*

KRALOY PVC CONDUIT is sold only through wholesale electrical supply houses.

NOTE WEIGHT COMPARISON — KRALOY PVC vs. ALUMINUM vs. STEEL CONDUIT

U.L. required minimum weight per 100 ft. including couplings, lbs.

K-59-29

Trade Size	½"	¾"	1"	1¼"	1½"	2"	2½"	3"	3½"	4"	5"	6"
KRALOY PVC	15.0	20.0	29.0	40.0	47.0	63.0	101.0	131.0	159.0	187.0	253.0	326.0
ALUMINUM	27.4	36.4	53.0	69.6	86.2	115.7	182.5	238.9	287.7	340.0	465.4	612.9
STEEL	79.0	105.0	153.0	201.0	249.0	334.0	527.0	690.0	831.0	982.0	1334.0	1771.0

For complete information on KRALOY PVC CONDUIT and installation directions, mail the coupon or write to **Kraloy Plastic Pipe Co., Inc., 4720 East Washington Blvd., Dept. EWT-11, Los Angeles 22, Calif.**

NO CONDUIT REPLACES **KRALOY**

Kraloy Plastic Pipe Co., Inc., Dept. EWT-12
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Gentlemen: Please send me your new Brochure on KRALOY PVC CONDUIT which gives complete information and installation directions.

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Address _____

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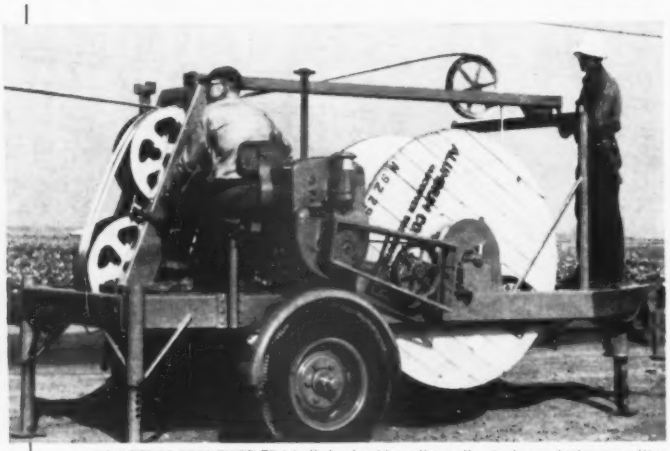
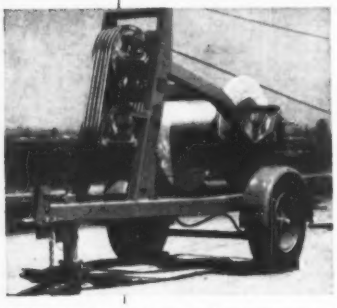
Now—A budget priced **PENGO TENSION STRINGING "TEAM"** for faster, safer, lower cost wire stringing!



NEW PENGO 5500 BWCP TR-I bullwheel cable puller pulls single conductor or pulling line, at tensions to 1,700 lbs. at 3 mph in high gear, or to 3,100 lbs. in low. Takes reels to 44" wide by 69" diameter. Neoprene-lined bullwheels take manila rope to 1¼" diameter; or smaller pulling lines and conductors. Powered by 25 hp gas engine; 2 man operation. Ideal for use with PENGO 5000 series tensioners (see below).



PENGO 5000 STR-I-34 combination tensioner and reel dolly has Neoprene-lined bullwheels to take conductor sizes up through .96 (565, 500 CM), handles reels to 34" x 72". The PENGO 5000 STR-I-54 is similar but larger and stronger, for larger and heavier reels to 44" x 72"

Here's a chance to gain all the economy, speed and safety of *tension* wire stringing at an investment that won't strain your line construction equipment budget.

The new PENGO 5500 Bullwheel Cable Puller pictured above, teamed up with a PENGO 5000 series tensioner, gives you a wire-stringing combination that keeps the conductor in the air all the way, makes it easier and safer to string over energized lines.

PENGO tension wire stringing equipment is available for any size conductor, for all stringing conditions. You'll be hours and dollars ahead to consult us *now* on planned line construction. We invite your inquiry. Dept. F 12

New PENGO-MILLER Line Stringing Swivels

Special models of the well-known MILLER swivels have been redesigned specifically for tension line stringing use, through collaboration between Petersen Engineering Co., Inc., and Miller Swivel Products, Inc.

The result is a reliable, heavy duty swivel of proper dimensions to pass through stringing sheaves and bullwheel grooves easily, without damage.

PETERSEN
ENGINEERING CO., INC.
Santa Clara, California

Telephone AXminster 6-7712

B-8

People

Hubbard

Montagriff

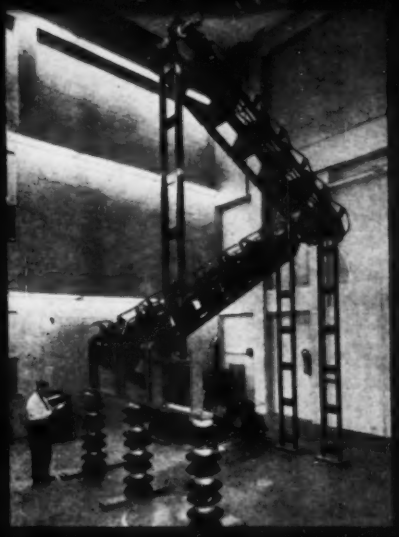
► **Ralph B. Hubbard,** manager of Rocky Mountain Electrical League, will retire Jan. 1 and is to be succeeded by **B. P. Montagriff.** Hubbard has been in the utility industry nearly 46 years and has been manager of RMEL since 1945. Prior to this date his career was with predecessor and affiliated companies of Public Service Co. of Colorado. Montagriff, who is an industrial sales engineer with Public Service Co. of Colorado, has been with the company since 1930. He is a graduate of the U. S. Naval Academy and a registered professional engineer.

► **Walter H. Kanzler,** assistant to the chief engineer, Bonneville Power Administration, has been awarded the Distinguished Service Award and Gold Medal, highest tribute paid by the Department of Interior. In his 20 years with BPA he has played a major role in development of policies in connection with construction of the world's largest high voltage transmission system.

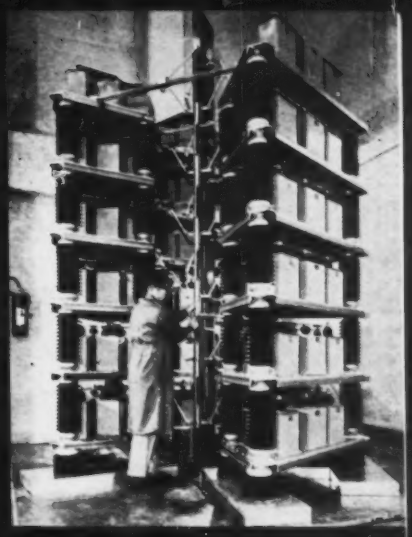
Kanzler

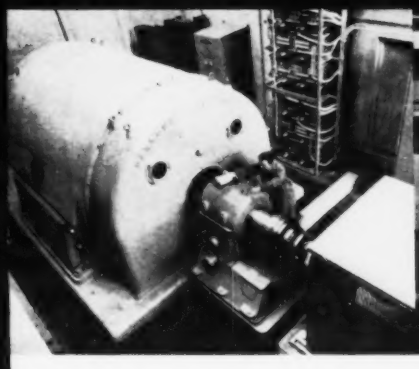
► **Reese Gwillim** has been appointed a full-time representative in northern California of Advance Transformer Co. He is a graduate of Alabama Polytechnic Institute and has had many years' experience in sales of fluorescent lamp ballasts in this territory.

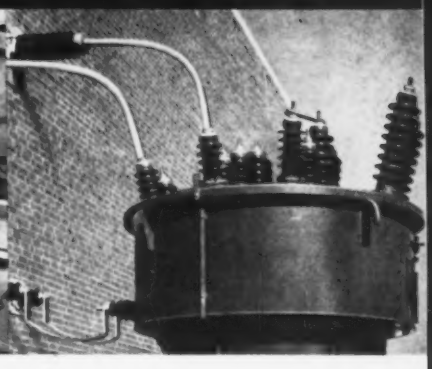
► **Dr. Edward L. Clark** is Colorado's new director of natural resources. In the new position he will be responsible for coordinating policies of 17 state agencies in the natural resources field. He was a consultant to President Eisenhower's cabinet committee on water resources national policy in 1954.



JOSLYN EXPANDS ELECTRICAL LABORATORY







KEEPING PACE WITH ELECTRICAL PROGRESS

The unique Multi-Purpose, Joslyn-Designed Impulse Generator is illustrated at the upper left. In the extended position as shown, the generator can deliver standard impulse voltage waves up to 1,800,000 volts. By folding the generator so that the three capacitor banks are parallel to each other, fast rates of current rise as high as 40,000 amperes per microsecond may be obtained. Also, with the insertion of proper coils and resistors, a low-current, long-duration surge current (up to 300 amperes, 3,000 microseconds long) for testing valve-type lightning arresters may be obtained.

At the upper right, the Surge Current Generator used for testing the ability of protective equipment to cope with lightning discharges is shown. This generator will deliver as much as 125,000 amperes (crest) at 150,000 volts.

In the center, there is a view of the Control Room which includes all the necessary modern equipment for measuring the electrical performance of Joslyn products.

At the lower left, the High-Current, 60-Cycle Power Generator with its 1,000-horsepower Driving Motor is illustrated. The mechanical stored energy in the 41-ton rotating generator field can be converted momentarily to more than 300,000 kva of electrical energy for testing circuit-interrupting devices.

The specially designed Test Transformer supplied by the High-Current, 60-Cycle Power Generator is shown at the lower right. The many bushings on the cover permit external winding connections for obtaining any test voltage up to 72,000 volts.

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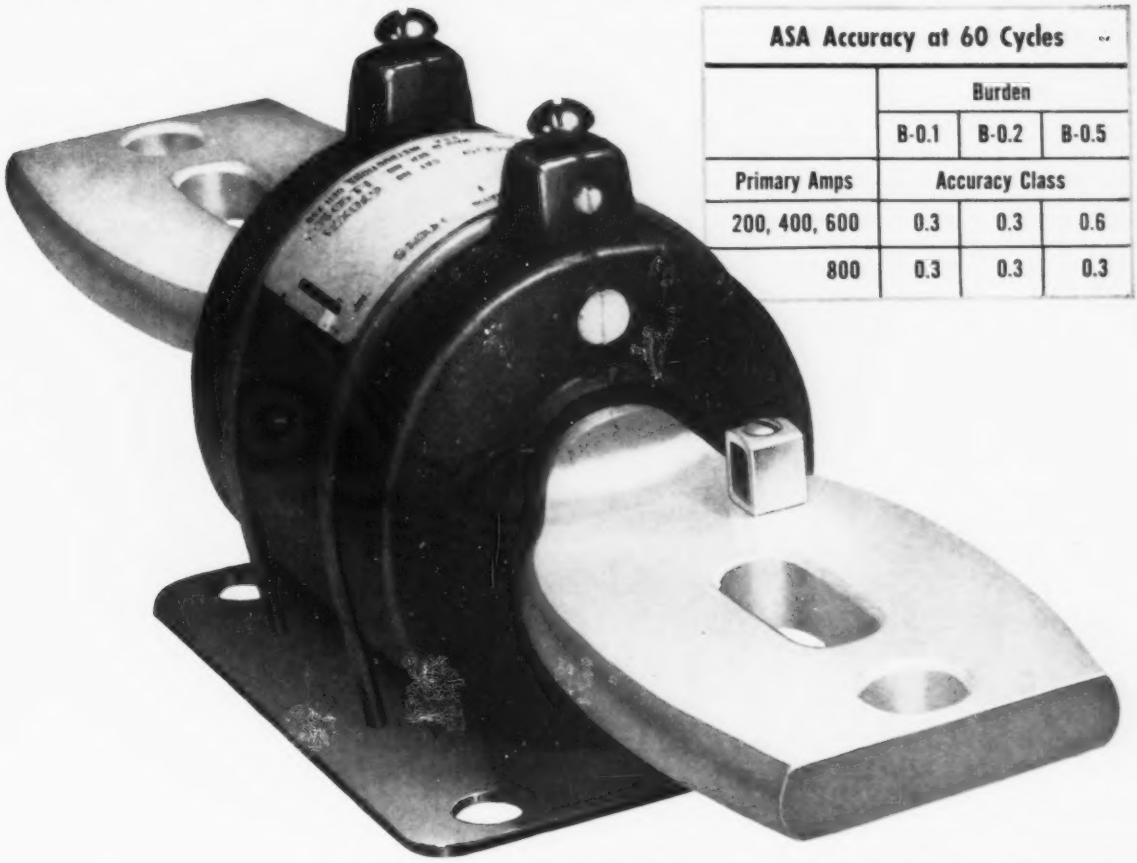
SAVE UP TO 40% ON NEW INDOOR CURRENT

JCX-0 line available in 200, 400, 600, and 800:5-ampere ratings

A full line of low-priced, miniature, indoor current transformers is now available from the General Electric Company. Designated "Type JCX-0," the new, butyl-molded units are available in 200, 400, 600, and 800:5-ampere ratings, with non-removable primary bar. Design simplification and standardization in the JCX-0 line permit prices as much as 40% below those for equivalent indoor-outdoor transformers. Specifically for indoor use, all JCX-0 transformers carry a new, grain-oriented, silicon-steel core

GENERAL ELECTRIC BUTYL TRANSFORMERS

ASA Accuracy at 60 Cycles			
	Burden		
	B-0.1	B-0.2	B-0.5
Primary Amps	Accuracy Class		
200, 400, 600	0.3	0.3	0.6
800	0.3	0.3	0.3



800:5-amp General Electric Type JCX-0 Current Transformer (actual size)

having a saturation point considerably above that of cores used in standard indoor-outdoor models. **FOR MORE INFORMATION** on General Electric's complete, new line of JCX-0 current transformers, contact your G-E apparatus salesman. Or, write General Electric Company, Section 629-4, Schenectady 5, N. Y.

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GENERAL ELECTRIC

► **Henry H. Schwager,** manager of engineering for Portland's Schwager-Wood Corp., has been added to the technical committee of Portland's Engineering & Marketing Associates Inc.

► **R. Scott Griffith** recently resigned as public relations and advertising representative of the Southern Nevada Power Co. in Las Vegas to establish his own firm, R. Scott Griffith & Associates, Public Relations & Advertising. Griffith joined the staff of the electric utility in November 1955. He will continue to serve the company on a consultant basis.

► **Henry G. Kuhn** has been appointed chief engineer for Lynch Carrier Systems Inc., San Francisco. With more than 20 years' experience in communications with emphasis on carrier telephone and telegraph circuitry and equipment, his most recent employment was with Lenkurt Electric Co., San Carlos, as executive staff engineer, specializing in carrier telephone remote control and communication switching systems.

Kuhn

► **Robert R. Crichton,** last of the Pacific Power & Light Co. employees who served under both of PP&L's predecessor companies in the Casper area, has retired after 37 years of service in the electric utility industry. He was PP&L's engineering statistician in Casper.

► **Donald R. Miller** has been appointed assistant to **Frank M. Warren,** president of Portland General Electric Co. He replaced **Fred R. McMillan** who has been promoted to assistant general manager of PGE's customer service division.

► **Buell E. Wilcox,** an employee of the U.S. Army Engineers since 1935, has been made chief of the Engineering Division of the Portland District.

► **John T. Hood** is new manager of sales planning and promotion for the Pacific Northwest division of General Electric Company's apparatus sales division. He has been with the company since 1934, and since 1949 has been manager of the division's nearby Tacoma office.

Konkordy V. Abakumoff of Bonneville Power Administration has been awarded the Department of Interior's Meritorious Service award and silver medal for outstanding work in designing the layouts for 345-kv and 287-kv autotransformer switching structures as a standard installation for the BPA transmission system. Other noteworthy assignments completed by Abakumoff include analysis and utilization of a captured World War II German 230-kv air blast circuit breaker and translation of important Russian technical literature in the power field. Presentation was made by Administrator William A. Pearl on behalf of the Secretary of Interior

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► **Richard A. Vaill,** Western regional manager of Edwards Co. Inc. in Los Angeles and former San Francisco manager, has been elected to membership in the Los Angeles Sales Executives Club.

► **R. A. "Wedge" Boddington** is new manager of Cordova Public Utilities, Cordova, Alaska. He had been manager of utilities at Petersburg, and will be succeeded there by **Clarence Shay.**

► **George A. Haller** is new acting general manager of the Fairbanks municipal utility system. Former general manager, **Frank H. Mapleton,** retired. Haller had been his administrative assistant.

► **H. L. Briggs,** former general manager of the British Columbia Power Commission, has been appointed to the National Energy Board of the Dominion of Canada.

► **Brene S. Canaday** has been appointed acting manager of the Golden Valley Electric Assn. in Fairbanks. He replaces **Nick Eidem.** Canaday is a member of the board of directors of the association.

► **Scout H. Reed** has joined the Benton County, Wash., PUD as administrative assistant. He had been employed by the AEC at Hanford Works, Richland, Wash.

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San Jose:	1376 N. Tenth St. CYpress 2-9090
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► **A. L. Pollard,** operating manager of Puget Sound Power & Light Co., has become a Fellow of the American Institute of Electrical Engineers and was cited "for contributions to the development and operating management of a large electric utility." He has been in the electrical utility industry since 1915. His career with Puget Sound began in 1930 as superintendent of steam division. He is a registered engineer in the State of Washington, and a past president of the Electric Club of Washington.

Pollard

► **F. Tom Parks,** 69, retired vice president and director of Public Service Co. of Colorado, died at his Denver residence Oct. 22. He had retired in 1958 after 30 years with the company.

► **Douglas E. Bolton** is the new representative of the Kirlin Co. in Salt Lake City.

► **J. A. Longley** has been promoted to regional representative for transmission and distribution equipment for Allis-Chalmers Mfg. Co. New manager of the San Francisco district is **T. E. Meyers** and promoted to manager of the Portland district is **G. K. Lewis.** In making the changes, Meyers transfers from Portland to San Francisco and Lewis from San Francisco to Portland. Longley continues to headquarter in San Francisco.

Longley

► **Frank Saunders** has been appointed to the newly created position of assistant sales manager, Western Division, by William Brand & Co.

► **Jack Adams** left Southern California Edison Co., San Bernardino, to become the Fresno representative of Curtis-AllBrite Co. He was incoming chairman of the new Arrowhead Chapter, IES, so will be replaced by William Ritter. James McMillen, G-E Supply Co., manager, San Bernardino, will be vice chairman.

Keeping line clearance costs DOWN goodwill UP

Proven power equipment and Davey trained rope climbers . . . that's what makes Davey Surgical Line Clearance so economical. Utilities can rely on the dependable, efficient, and *adaptable* Davey crew. It will pay you to talk over your tree maintenance problems with the West's leading line clearing specialists—Call Davey.

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► **Verne Gill,** formerly of Capitol Wholesale Electric, Sacramento, is now Zinsco Electric Products' San Diego representative.

► **John Kyesich,** who was with Steber Lighting in Los Angeles, is now with Pyle-National in San Francisco.

► **Robert L. Skone** is now principal engineer, electrical design, for Seattle City Light. He has been with the utility since 1956, and was made supervising senior engineer in 1957. He is a graduate of the University of Washington and a member of AIEE.

Skone

► **Mart Noack,** who has been with Orangeburg for many years, is now representative of Commercial Lighting & Equipment Co. of Los Angeles, maker of fluorescent and incandescent starters and lamps, with offices at 681 Market St.

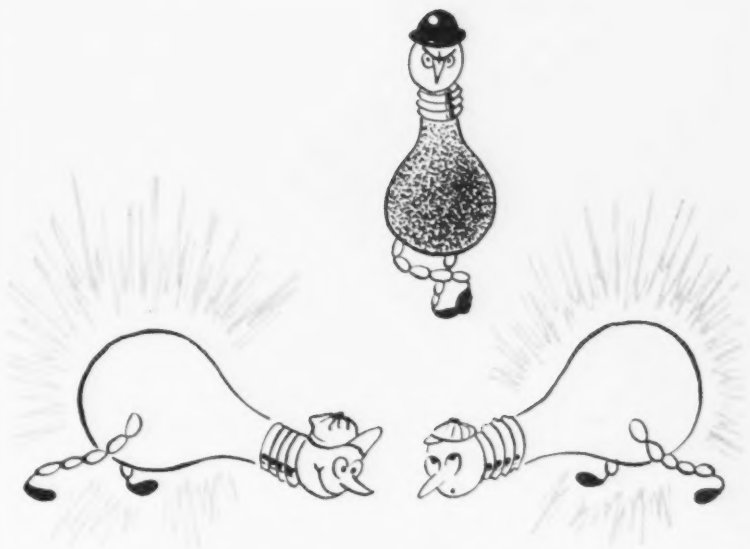
► **Max E. Nelson** has been appointed to the new position of employee relations manager of San Diego Gas & Electric Co. The new department takes over functions formerly handled by the industrial relations and personnel departments.

► **Robert W. Dickinson** has been appointed director of the Sodium Reactors Department of Atomics International. The Santa Susana Sodium Reactor Experiment comes under his jurisdiction.

► **Neil W. Plath** is new general superintendent of Sierra Pacific Power Co. He succeeds **F. G. Barnett,** vice-president and general superintendent, who retired in October. Plath has been with the company since 1936. For the past year and a half he has been assistant general superintendent.

Plath

► **Charles E. Goodwin** Jr., former San Francisco district manager of General Electric Supply Co., retired, has joined Paine, Webber, Jackson & Curtis, investment broker, as registered representative in San Francisco.



Lightning Bug-aboo

During the past three or four years, hundreds of thousands of Fisher-Pierce 6600A controls with a half a second time delay have yielded exactly *one* complaint about false turn-off reportedly caused by lightning. This field experience also includes many mercury vapor installations—one, in fact, where 4000 lights are individually controlled by 6600A units. What could be better proof that long time delay isn't necessary?

The facts and figures we've been able to dig up help explain why turn-off doesn't occur and why long time delay isn't needed. The intensity of the average flash—measured at the control—doesn't begin to reach the turn-off level, nor does it last for the necessary half-second. A flash rarely exceeds 0.001 second.

But even if the numbers are hard to believe, what has happened in the field still makes the most sense of all: lightning just doesn't make a good case for long time delay. It's a bugaboo that can cost you needless man-on-the-pole hours, if you let it bite you. The Fisher-Pierce Co., 43 Pearl Street, South Braintree 85, Massachusetts.

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AN AFFILIATE OF SIGMA INSTRUMENTS, INC.

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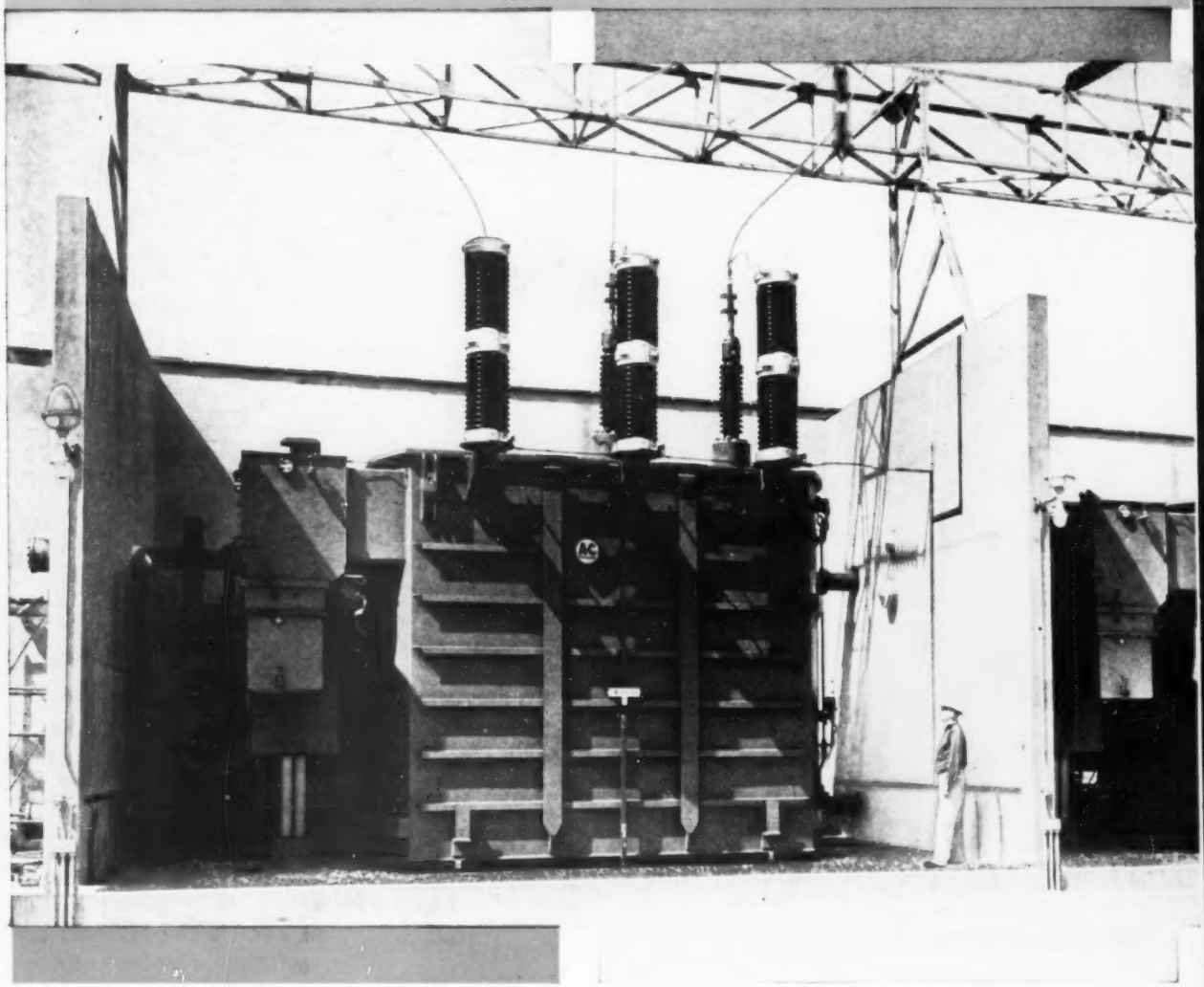
ALLIS-CHALMERS... Pacing



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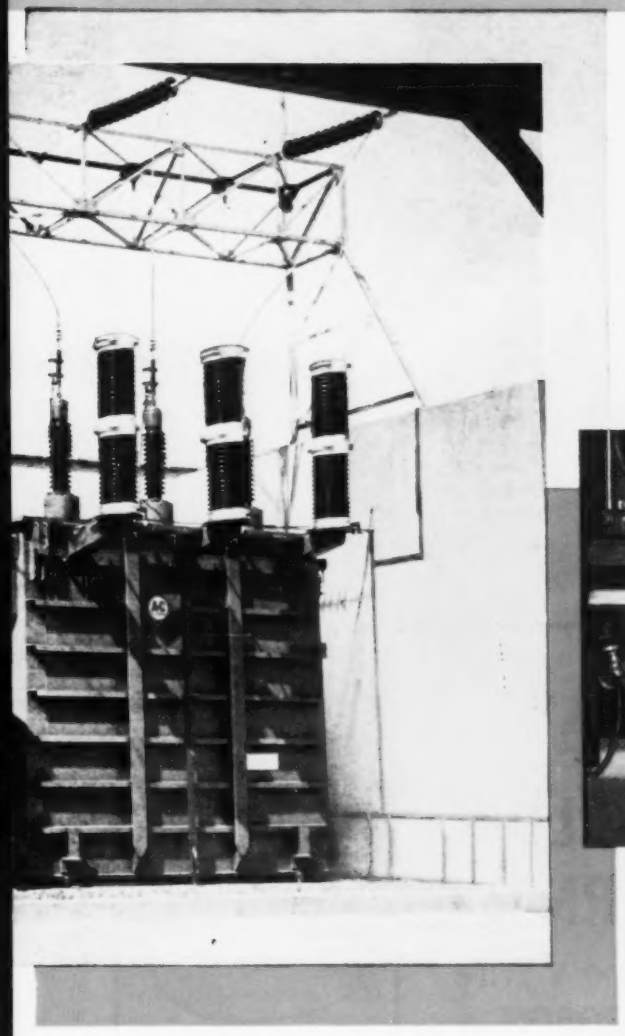
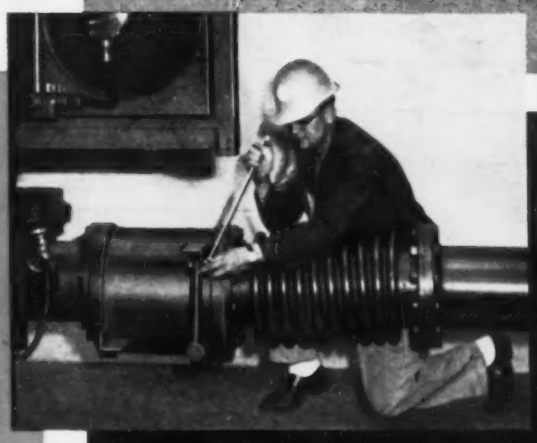
Power Progress





Manual shutoff valves serving transformer cooling equipment piping are opened when dual cooling is necessary. A transformer can be taken from service without draining the oil from the unit or its piping.

A-1155-E

Either of two 90-mva transformers is capable of carrying 2/3 of the combined capacity by using the "dual-cooled" feature

Wisconsin Electric Power Company counts on *designed-in* power transformer emergency capacity. Exclusive *dual-cooled* arrangement* uprates either one of the 90-mva transformers to 120 mva if the other is removed from the line.

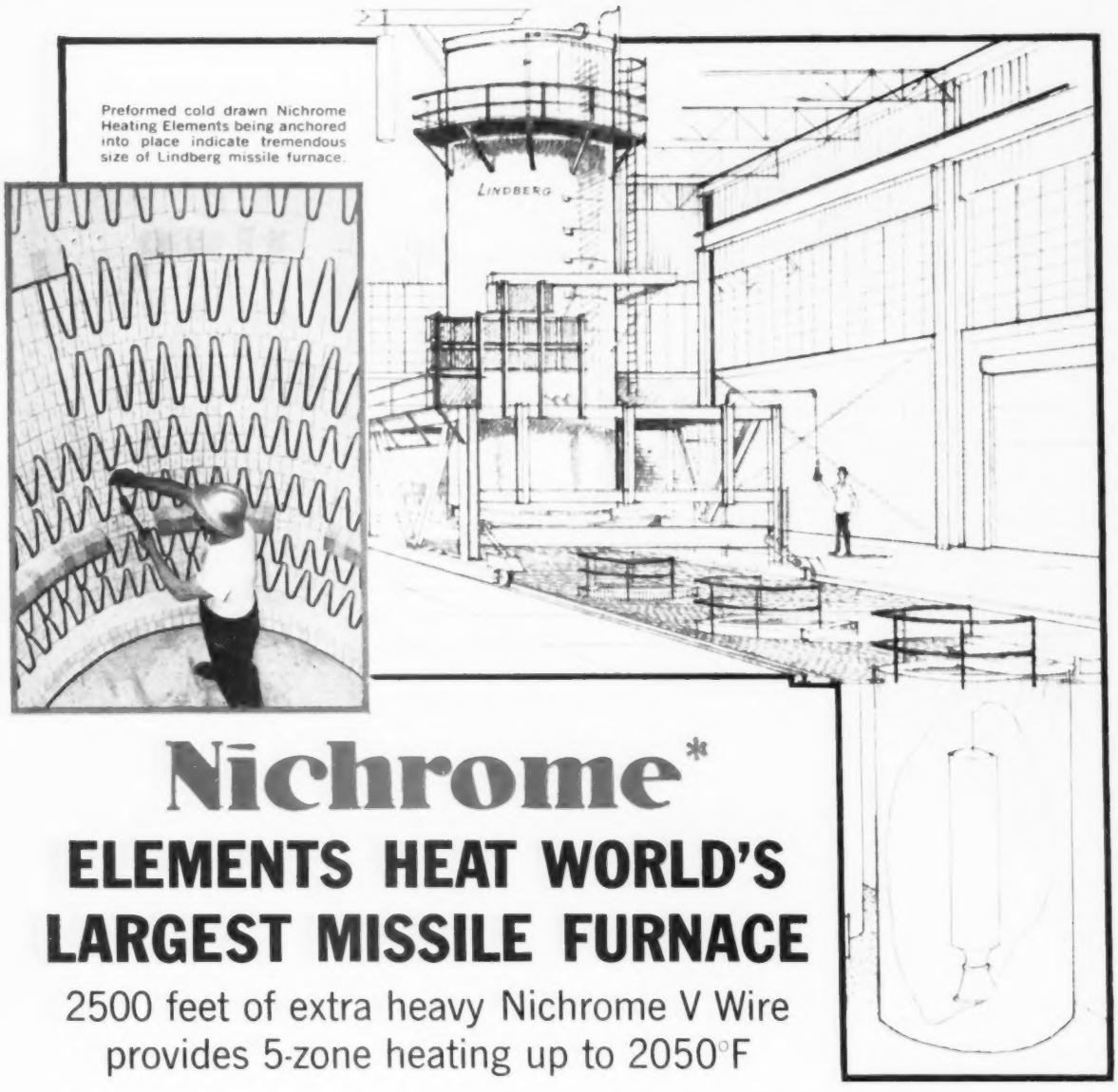
The active transformer utilizes all of the other unit's oil-to-air cooling equipment to dissipate heat. In normal operation, each transformer uses its own coolers independently.

Stepping down 138,000 volts to 13,800 volts, the transformer bank employs accordion-type expansion joints between transformers. Header pipes allow for manual cutoff. The installation has been designed to permit adding a third transformer should demand require it.

Dual cooling is but one of many A-C advantages resulting from continuing transformer research. Others include corona-free design, quiet operation, reduced size and weight, high short-circuit strength. A call to your A-C man will bring further dual-cooling power transformer details.

ALLIS-CHALMERS POWER FOR THE FUTURE

For phone number of closest representative see advertising index in back of book.



Preformed cold drawn Nichrome Heating Elements being anchored into place indicate tremendous size of Lindberg missile furnace.

Nichrome*

ELEMENTS HEAT WORLD'S LARGEST MISSILE FURNACE

2500 feet of extra heavy Nichrome V Wire provides 5-zone heating up to 2050°F

This giant 500 KW gantry type Lindberg† hardening furnace is the newest and largest ever built to meet the most exacting heat treating requirements of today's, and tomorrow's, missile metals. It accommodates an effective work load nearly 7 ft. in diameter and 24 ft. long.

Now in operation at Lindberg Steel Treating Company's Melrose Park Plant, the controlled atmosphere installation is both bottom loading and bottom quenching. The 19′ by 57′ pit—28′ deep, beneath the towering electrically heated furnace, houses the loading station, 2 quench tanks (atmosphere and salt) and water wash tank. Work loads pass from furnace to quench through an airtight seal, permitting complete control and precise duplication of atmospheres and treating cycles.

In the hardening furnace there are five control zones which operate between 250 F and 2050 F. Saturable core reactors automatically vary the voltage to the Nichrome*V heating elements between 2.2 and 220 volts, depending on temperature and load.

The selection of Nichrome V by Lindberg to supply reliable and closely controlled heat and temperature in this furnace is further evidence of the confidence that industrial leaders have in the quality and performance of Driver-Harris high-nickel alloys. Why not benefit from their experience. Tell us about your requirements. *T.M. Reg. U.S. Pat. Off. †Lindberg Engineering Company

DRIVER-HARRIS* COMPANY

HARRISON, NEW JERSEY • BRANCHES: Chicago, Detroit, Cleveland, Louisville

Distributor: ANGUS-CAMPBELL, INC., Los Angeles, San Francisco • In Canada: The B. GREENING WIRE COMPANY, Ltd., Hamilton, Ontario

MAKERS OF THE MOST COMPLETE LINE OF ALLOYS FOR THE ELECTRICAL, ELECTRONIC AND HEAT-TREATING INDUSTRIES

SPECIAL PURPOSE ALLOYS SINCE 1888 D/H TRADE MARK REG U.S. PAT. OFF.

Market Development

The three witches, left, stirred up the brew that caused Much Ado About Washing. Speaking is Seer Clara Sherburne, Hotpoint, who is straightening out a washday problem. The actors: Edna Poyner, Norge; Betty Buettner, G-E; Cleo Filsinger; Dorothy Hartman; Phyllis Larsen, General Foods; Luci LaFontaine, Calgon; Elizabeth Ehman, W. J. Lancaster; Willa Schmidt, U of C. The witches, Kathleen Brick, Union Oil; Janet McNair, PG and E; Kathleen Hayes, Dairy Industry of Northern California. Not in the picture, Mary Kelly, Philco, and Frances Brewer, consultant, who took the part of a page

Equipment Workshop

Bay area teachers and business home economists saw the new electrical equipment, live and in pictures, at the all-day workshop sponsored by the California Home Economics Assn., Home Economists in Business and Pacific Coast Electrical Assn. in San Francisco Nov. 11.

Plan carefully, equip wisely and beautify naturally are three guides to good kitchen design, according to Designer Janean Schaetzel. She showed before and after slides of kitchens that had been remodeled to put the proper equipment in the proper place and bring the "outdoors inside."

Features of the new ranges were told by Betty Buettner, General Electric, Clara Sherburne, Hotpoint, Edna Poyner, Norge, Mary Kelly, Philco, and Esther Day, substituting for Helen Randol, Westinghouse.

Betty Buettner, who came from Appliance Park for the workshop, described the new automatic defrosting freezers.

A parade of portable appliances showed these helpers in action and provided a number of useful recipes. This event was conducted by Evalyn Vaughan, Kathryn Moon and Janet McNair of Pacific Gas and Electric Co.

Much Ado About Washing, the skit pictured, was an adaptation of a performance at the recent AHEMA conference, with Western additions. Shakespearean characters bemoaned such washday horrors (brewed by the witches) as spots, hard water, the difficult choice between soaps and detergents. Seers among the electrical industry told how to dispel these troubles and confound the witches.

Crowds around the laundry equipment put on display following the skit showed a lively interest in late methods and models.

► **Dick Grundy**, lighting engineer in PG and E's San Francisco division, was top winner for six months of **Northern California Electrical Bureau's** commercial and industrial lighting contest. He won a Polaroid-Land camera with accessories. Another camera will be given for the second six-month period.

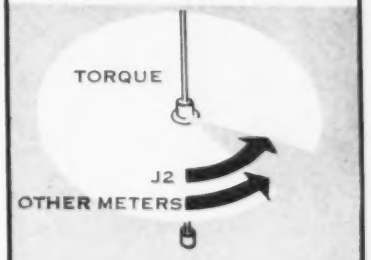
METERMAN'S CHECK LIST

Get Sustained Accuracy Even as System Capacity Grows

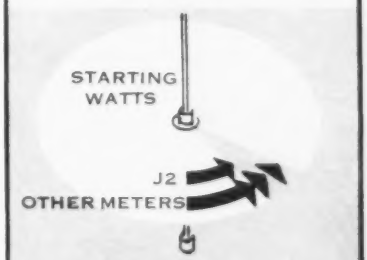
Sangamo J2 Watthour Meters provide the long-life accuracy that is so essential as test intervals lengthen and residential loads increase. Uniform load curves from 1.5 through full 200 amperes prove the J2's sustained, "straight line" accuracy on both light and heavy loads.

The J2, with its slow speed, exceptionally high torque, and ability to begin measuring on fewer starting watts than other meters, provides unexcelled extended range metering for all services, present and potential.

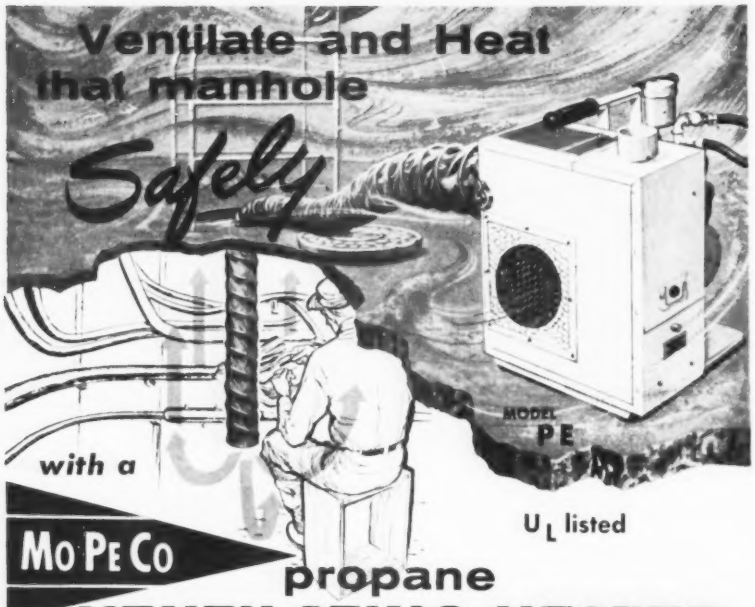
SANGAMO ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS



UP TO 15% MORE TORQUE



UP TO 25% LESS STARTING WATTS



MO PE CO propane
VENTILATING HEATER

Fresh Air . . . heated fresh air in one portable unit!

- Weighs only 62 pounds
- 300 to 800 cfm fresh air
- 10° to 96° temperature rise
- Propane or Butane fuel
- 10' L.P.G. hose standard
- Safe fresh air blown into manhole at all times.
- Eliminates manhole explosion and oxygen deficiency accidents.

Order through your favorite distributor.

WRITE FOR ILLUSTRATED BROCHURE SHOWING ALL MoPeCo MODELS.

Write or Call **MORRISON-PELSUE COMPANY**
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"Blue Chip" Products for Volume, Prestige and Profit

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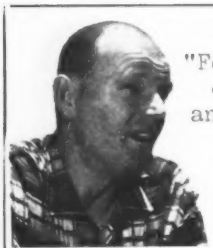
CORDS and CORD SETS
for Home, Farm and Industry

Plastic, rubber, neoprene Service Cords in 250-ft. spools, individually cartoned in boxes-of-four for convenience in handling. Loose-wound cord sets, relaxed to forestall ozone attack.

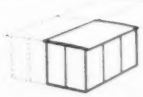
THE *Quality* LINE

CORNISH WIRE CO., INC.—50 Church St., N.Y.C.7
LOS ANGELES 1848 No. Main St. SAN FRANCISCO 1301 Sixth St. SEATTLE 129 First Ave., West



"For a combination electrical field office and storage shed that's quick to move on and off the job, I like Porta House. We have them on several jobs."

Just telephone Porta House collect and get immediate delivery. Prefabricated, bolted, waterproof plywood panels—can be moved on a pick-up truck.



SIZES 6' OR MORE BY 9' OR MORE

PORTA HOUSE

Ridgely K. Dodge 6767 Broadway Terrace, Oakland, Calif

Phone collect for immediate delivery: OLympic 2-7237

Electric Heat Forum In Spokane

An electric heat forum recently held at Washington Water Power auditorium was attended by some 80 electric heat contractors, dealers and distributors. R. C. Cornelius, Richard F. Page of Norris-Thermador, W. V. Killian of Herman Nelson and Will DeNeff, architect, were among those addressing the group. Apartment house, commercial building and school heating were particularly stressed. A total of 161 electric heat jobs was installed for a total of 2,078 kw in September.

Medallion Council Sees 1960 Growth

Construction of Medallion Homes in southern California will break all records by the end of 1959, utility representatives said as they met in San Bernardino to discuss 1960 plans.

Members of the Medallion Home Council of Southern California reported that by the end of the year a total of 23,300 qualifying homes will have been built in the area. They pointed out that the area leads the nation in Medallion Home construction and said they expect a big year in 1960.

Members of the council attending the meeting included: J. C. Meserve and V. F. Martin, Southern California Edison Co.; Hugh C. Cate and V. A. Behrentsen, Los Angeles Department of Water & Power; A. J. McCutcheon and Arthur R. Ellis, San Diego Gas & Electric Co.; B. K. Campbell, Riverside Electric Department; Ralph Munson, John R. McNeese and C. E. Kiefer, California Electric Power Co.

Space Heating Study

Almost doubling its domestic space heating customers in two years, Seattle City Light reported a total of 16,725 following a recent survey. There are 262,122 meters on the system.

Installations are about equally divided between private homes and apartments but the majority of new units are in apartments.

A City Light sampling of billings indicates the effective rate last year was about 1¢ per kwh for apartments and 1.1 to 1.2¢ for single-family detached homes. Last winter was mild, however, and the effective rate will rise with colder weather, the utility pointed out.

NEMA Officers

N. J. MacDonald of Elizabeth, N. J., president of Thomas & Betts Co., was elected president of the National Electrical Manufacturers Assn. at NEMA's 33rd annual convention in Atlantic City. He succeeds J. L. Singleton of Milwaukee, Wis., senior vice-president, Industries group, Allis-Chalmers Mfg. Co.

W. C. Wichman of Chicago, vice-president of General Electric Co. and general manager of the company's Hotpoint Division, was elected vice-president. A. D. R. Fraser of Rome, N. Y., president of Rome Cable Corp., was elected treasurer.

Reddy's '60 Program

A new technicolor film, *The Mighty Atom*, is one of the features in the Reddy Kilowatt public relations program for 1960. Ash Collins reports that the history of electricity is dramatized right up to the minute and is brought to the customers in terms they can understand—customer benefits.

In addition to the 17-minute, cartoon-type movie, the new program offers a story book and a stamp album. With the album are poster stamps showing some of the film sequences.

► **Frederick P. Ciambrone** has been named assistant general manager of Stromberg-Carlson—San Diego.

► **George W. McGinley** has been appointed sales manager of Stromberg-Carlson—San Diego. He will be responsible for all sales activities for the line of high-speed electronic printers, data display and recording devices. **Warren C. Dunn,** manager of marketing, announced.

► **John Anderson** has joined New Mexico Electric Service Co., as commercial salesman and dealer coordinator. **Cleta Price** has been added to the staff as home service advisor, and plans to help customers in use of appliances as well as to conduct cooking schools and demonstrations.

► HECO's Load Builder **won the Hawaiian "Oscar"** for employee magazines at the 10th annual Communications Conference of the Hawaii Employers Council. The award was a wooden Tiki god, Akoni. The magazine, published by Hawaiian Electric Co., is edited by Mary Morton, under supervision of Carl J. Schiffers, administrative vice-president.

Manufacturers—Distributors

New Quarters for Rep

Guy de Leuze Co. will move into new quarters at 1923 Bryant St., San Francisco, about the middle of December. Guy de Leuze for 28 years was connected with Panama Lamp & Commercial Co., becoming president in 1955. Following sale of this firm to Champion Lamp Works, he started his own business as manufacturers' representative at 1485 Bayshore Blvd. in the Sales Mart, moving a year later to 221 Oak St. in San Francisco.

The new warehouse and office will have about 5,000 sq ft of open space on one floor with office and mezzanine for display of merchandise. Joseph Sartuche has been added to the staff to cover the Sacramento and San Joaquin Valley areas. De Leuze will cover the San Francisco Bay area and the coast. Howard Winsor will contact architects and engineers. Alice de Leuze will continue as office manager.

► **Peerless Electric** Co., Warren, Ohio, has become a division of **H. K. Porter** Co. Founded in 1893, Peerless is a major supplier of custom-built electric motors and also manufactures fans, blowers and ventilating equipment for commercial and industrial applications.

► **Westinghouse Electric Corp.** has extended its independent agent and distributor agreements with **Phillips & Edwards Electric** Corp. to include locations of the northern California Incandescent Supply Co., recently consolidated with Phillips & Edwards. **Walter J. Maytham,** Pacific Coast regional vice-president for Westinghouse, said that under the new agreement all 10 northern California operating companies included in the merger will be operating as full line agents and distributors of industrial apparatus for Westinghouse.

► **Norman Rupp** Co., 103 S. W. Front St., Portland, has been appointed manufacturer's representative for Oregon, Washington and Idaho of the **Elmag Clutch & Brake Division,** McCauley Industrial Corp., Dayton, Ohio. The firm manufactures Elmag electromagnetic multiple disk clutches and brakes.

METERMAN'S CHECK LIST

Get Consistent Overload Accuracy and Reduced Wear

Sangamo J2 Watthour Meters are the only meters that match slower disk speed with increased overload capacity. The result: more uniform load curves, and reduced wear on all moving parts, fewer repairs and replacements, longer meter life, more economy.

64,000 fewer revolutions per day

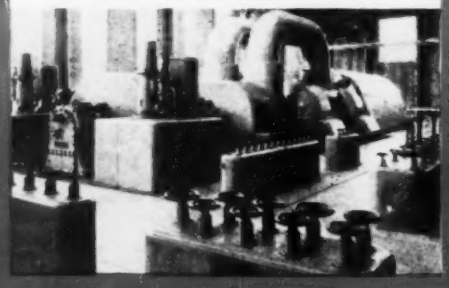
In one day, the disk of a conventional Class 100 meter operating at full capacity makes 160,000 revolutions. The J2 makes 64,000 fewer. Actually, the J2 makes only 10 revolutions per minute at full name-plate rating. That's a full 40% slower than any other meter.

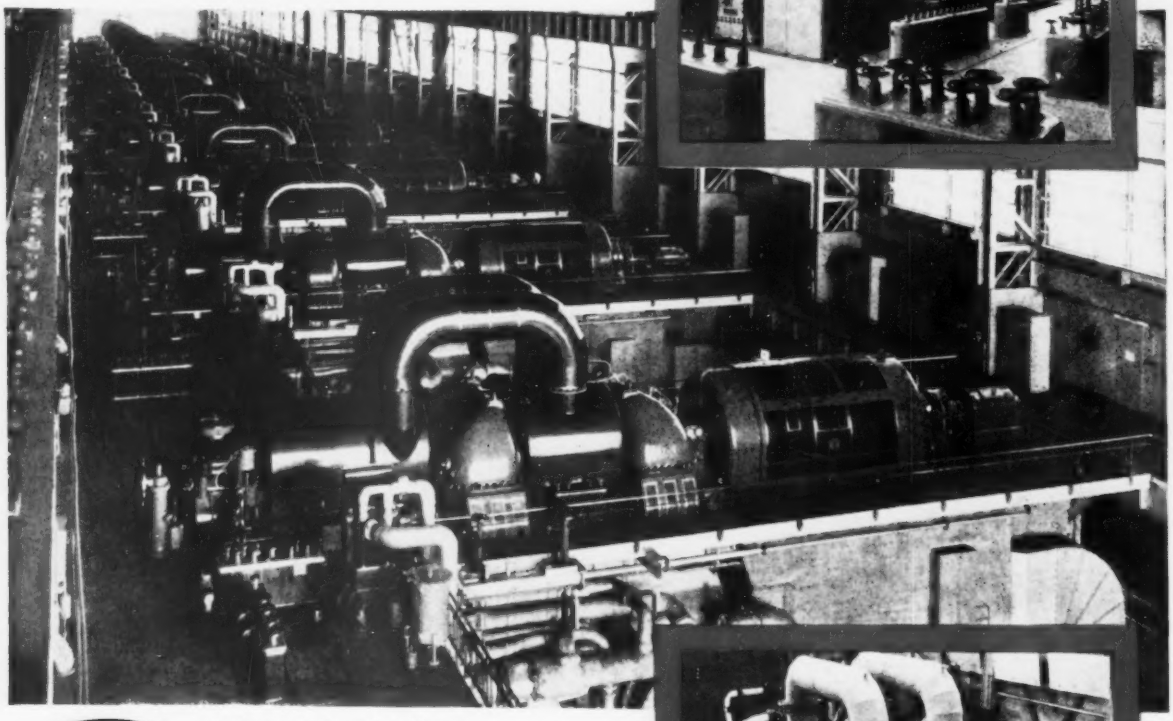
SANGAMO Electric Company
SPRINGFIELD, ILLINOIS

DEVELOPING WORLD PROSPERITY

GREECE

St. George's Bay Power Station, Athens. This 60 MW turbo-alternator set and a 14·25 MW topping set have been supplied for the extensions to this station which was originally equipped by 'ENGLISH ELECTRIC' in 1929 with three 15 MW sets.



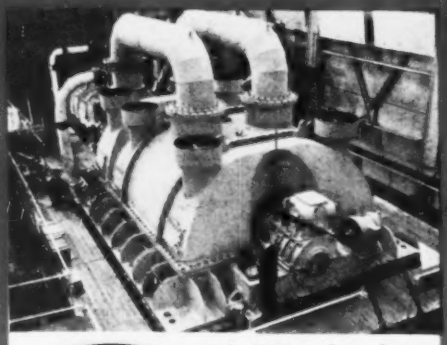


SOUTH AFRICA

Vierfontein Power Station, South Africa—twelve 'ENGLISH ELECTRIC' 30 MW turbo-alternator sets. These sets, running at 3,000 r.p.m., are designed for steam conditions of 600 p.s.i.g., 825 F at the turbine stop valve.

Backed by over 55 years' experience, 'ENGLISH ELECTRIC' is today manufacturing steam turbo-alternator sets amongst the largest in the world, including two 275 MW units and five 200 MW units for the Central Electricity Generating Board of the United Kingdom. Many hundreds of sets, both large and small, have been supplied to public utilities and industry throughout the world.

'ENGLISH ELECTRIC' products cover all aspects of the generation, transmission and utilization of electric power. Contracts have been completed and others are in hand for many major American power projects.



GREAT BRITAIN

High Marnham Power Station, England. Works tests on the first of five 200 MW, 3,000 r.p.m. three-cylinder turbines which will operate at 2,350 p.s.i.g., 1,050 F at the turbine stop valves, re-heat to 1,000 F.

'ENGLISH ELECTRIC'

Agents: ENGLISH ELECTRIC EXPORT & TRADING CO. LTD., 750 THIRD AVENUE, NEW YORK 17, N.Y. Tel: MURRAY HILL 7-0303

Sub Agents:—

James I. Metcalf & Co. Inc., 701 United Pacific Building, Seattle 4, Washington. Branch offices in San Francisco, Los Angeles, Portland, Phoenix, for Alaska, Arizona, California, Idaho, Montana, Nebraska, Nevada, Oregon, Utah, Washington and Wyoming.

Osgood and Associates Inc., 988 Spring St., N.W., P.O. Box 7383, Station C, Atlanta 9, Ga., for Alabama, Florida, Georgia, Kentucky, South Carolina and Tennessee.

Electron Equipment Co. Inc., 1050 Constance St., New Orleans, 13, La., for Louisiana and Mississippi.

Peabody Bros., 2903 St. Louis St. at Oakland, Dallas, 26 Texas. Branch offices in Houston and Tulsa, for Arkansas, New Mexico, Oklahoma and Texas.

SERVICE FACILITIES ARE AVAILABLE THROUGH THREE LARGE CANADIAN PLANTS

OC/US/5

Shown at ground-breaking ceremony for new Lighting Dynamics plant in City of Industry, Calif., recently are: Ted R. Cooper, architect and contractor; Jim Duncan, plant manager; Kim Moe, vice-president, Virden Co. (parent corporation of Lighting Dynamics); Jim Bond (with shovel), vice-president and general manager, Lighting Dynamics; Bob Ramsing, assistant general manager; Don Henderson, comptroller; John Sankewich, general sales manager; and Bill Jackson, regional sales manager—all of Lighting Dynamics

► **ASEA**, Swedish electrical manufacturing concern, has opened a sales office in San Francisco through its American subsidiary, ASEA Electric Inc., 500 Fifth Ave., New York. Manager of the new office at 55 New Montgomery St., San Francisco, is **Olov G. Berglund,** who has been with ASEA for 10 years in machine design and sales engineering. His experience also includes work with Bechtel Corp. as electrical engineer and with H. B. Maynard & Co., Pittsburgh, Pa., as management consultant.

Berglund

► **Dan H. Radke** Co. has been made northern California representative of **Luminous Equipment** Co., Chicago, manufacturer of lighting for hospital rooms.

► **Abolite Lighting** has announced appointment of **Dan H. Radke Co.,** 751 Natoma St., San Francisco, as northern California representative. Abolite manufactures a complete line of RML reflectors, floodlights and high bay incandescent and mercury unit lighting fixtures.

► **Bill Earl** of Don Burcham Co., 510 N. W. 19th Ave., Portland, reports a new indoor TV antenna offered by **Jerrold Electronics** that hooks onto the power cord and, in effect, uses housewiring as an antenna.

► **Wayne C. Wells** Co., 6055 N. E. Glisan St., Portland, has been appointed manufacturer's representative for **Commercial Plastic** Co., Chicago, manufacturer of plastic cable clamps.

► **Clifford E. Mathewson** has been named manager of advertising and public relations for **Daystrom** Inc., Control Systems Division. He has been in the instrument industry for the past 11 years. Prior to joining Daystrom in 1957, he was sales manager of Kybernetes Corp.; before that, product manager of Electronic Instrument Division of Manning, Maxwell & Moore. With headquarters at 1455 Miramar Road, La Jolla, Calif., the division designs, develops and manufactures complete data handling and process control systems.

Mathewson

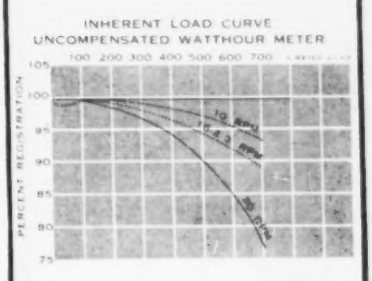
► **Robert K. Miller,** president of the **Holly-General** Division of Siegler Corp., has been elected a vice-president of the parent corporation, **John G. Brooks,** Siegler president, announced.

METERMAN'S CHECK LIST

Greater Overload Capacity With Less Compensation

The Sangamo J2 Watthour Meter needs less compensation for "straight-line" accuracy. Its individual overload curves are more uniform, too.

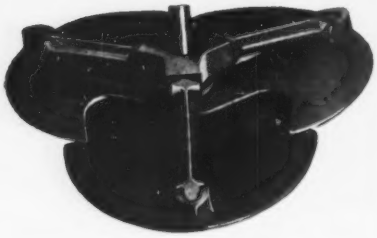
These built-in "plusses" come from the J2's slow, 10 revolutions-per-minute disk speed. Check this: current damping, which varies directly with the current flux squared and the disk speed, causes the phenomena of reduced registration on higher loads. With a slow speed J2, current damping plays a smaller role in overload accuracy.



As can be seen from the curves on the graph, the inherent load curve of an uncompensated 10 rpm meter is substantially better than meters with higher speeds. The slow speed of the J2 also reduces wear on moving parts.

SANGAMO
Electric Company
SPRINGFIELD, ILLINOIS

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life

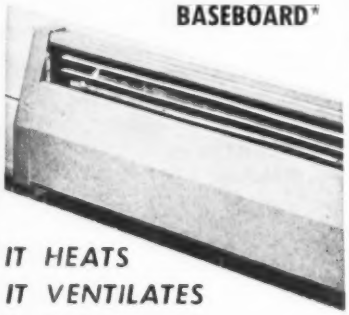


EVERSTICK ANCHORS

For new construction and maintenance — Everstick Anchors speed up work and provide dependable anchorage on all types of jobs. Made of resiliant, rust resistant malleable iron. The toughest anchors made. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

PREMIUM COMFORT . . .
REASONABLY PRICED
WITH HEATSUM VENTILATED BASEBOARD*



IT HEATS
IT VENTILATES
IT CAN FILTER
THE AIR TOO

*MANUFACTURED ONLY BY:
ROBERSON INC.
7116 220TH SOUTHWEST
MOUNTLAKE TERRACE, WASH.

Partial view of equipment on display at Calavar Corp.'s Gay 90s Festival celebrating dedication of its new engineering and manufacturing center in Santa Fe Springs, Calif. The display included nearly $1 million worth of heavy-duty equipment, its own and that of manufacturers whom it represents. Old-time vehicles were shown along with the new models. The firm, headquartered at Los Angeles, is headed by Robert L. Koehler

► **A. B. Chance** Co. has moved its Northwest ServiCenter headquarters from Chehalis, Wash., to Seattle. **Don Newton** is supervisor of the new center at 1534 First Ave. S.

► **Fred Meyer**, who has been with **A. B. Chance** in San Francisco and Los Angeles, will move to Phoenix as sales representative for the State of Arizona.

► **A. W. Davis Co.**, Portland, and **Waterworks Supplies** Co., Portland and Spokane, have been appointed jobbers for the **Esco** line of transistorized road barriers, represented in the Northwest by **Vic Paul** Co., 510 N. W. Hoyt, Portland.

Earnings

Allis-Chalmers reported a 34% increase in third-quarter sales as compared with 1958 and a 103% increase in earnings for the period. Third-quarter sales in 1959 amounted to $166,622,772 and earnings, after preferred stock dividend requirements, $10,034,614, President R. S. Stevenson said. Nine-month sales totaled $387,819,262; profits were $15,454,928. Earnings per share of common stock at the end of the period were $1.69.

A 16% sales gain for the six-month period ending Sept. 30 as compared with the same period last year was reported by **R T & E Corp.** Profits for the same period decreased $23,128 because of the substantial price decrease in March, Rolland D. Nelson, president, said.

A strong third quarter boosted **General Electric** earnings for the first nine months of 1959 to a new record—$189,512,000—Board Chairman Ralph J. Cordiner announced. This is an increase of 17% as compared with the subnormal period last year. Net sales billed amounted to $3,142,297,000, an increase of 5% over the first nine months of 1958 and within 1% of the 1957 peak. Earnings were equivalent to $2.16 a share of common as compared with $1.85 for the same period of 1958 and $2.10 for the 1957 period.

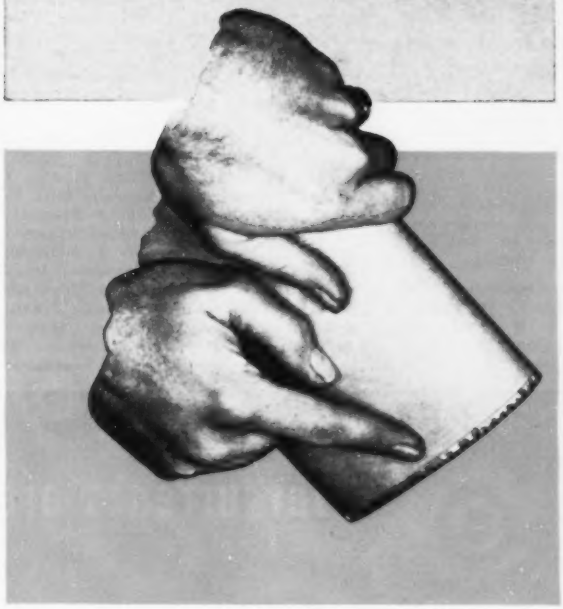
Record earnings for the first nine months of 1959 were reported by **Thomas Industries.** Lee B. Thomas, board chairman, said earnings were up 54% as compared with the same period of 1958 and totaled $1,183,584. Net sales were $25,247,317, up 63%.

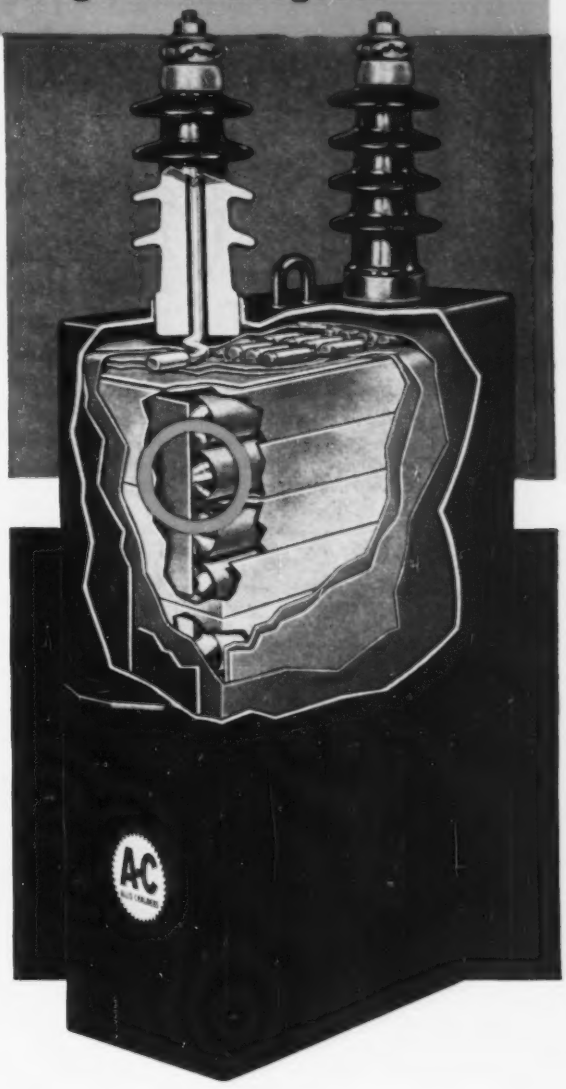
Westinghouse announced the highest third-quarter earnings in its history. Net income after taxes for the three months was $22,075,000, equal to $1.25 a common share on near-record billings for the period of $494,189,000. Net income for the first nine months of 1959 was $56,225,000, or $3.17 a common share, according to Mark W. Cresap Jr., president. The board of directors raised annual dividend rate on common stock from $2 to $2.40 and recommended a two-for-one split, which will be voted on at a special stockholders meeting on Jan. 4, 1960.

ALLIS-CHALMERS... Pacing Power Progress

EXTENDED-FOIL COOLING...

- reduces hot-spot temperatures
- lengthens service life





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Association Affairs

"I only wish I could take with me what Arthur Rowe is taking with him as he retires—friendship, respect, honor," was the tribute paid Rowe at a testimonial dinner given him by Electrical Industry (Bid) Depository of California, Nov. 17. At head table: George Abbett, C. B. Kenney, Arthur Rowe, William Mohrdick, W. Nagle

PCEA Appointments

President Charles A. Wikle has announced the following additional committee appointments:

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Appliance—Chairman W. H. Mayben, Graybar Electric, Vice-chairman F. E. Lucking, Calectric; Ralph Alden, Arizona PS; Dan Alexander, PG and E; Lew Ankersen, Hotpoint; F. A. Ballman, Thermador; Dan O. Bland, Arizona Wholesale Supply; F. L. Bowles, So. Calif. Ed.; John Downing, Kelvinator Sales; Harry Gough, G-E; Carl O. Hagstrom, General Appliance Co.; Perry Knox, PG and E; R. F. MacGillivray, Westinghouse Supply; F. W. Meise, San Diego G&E; Dick Sanford, Leo J. Meyberg Co.; M. D. Schuster, Philco; Robert Sloan, Norge Sales.

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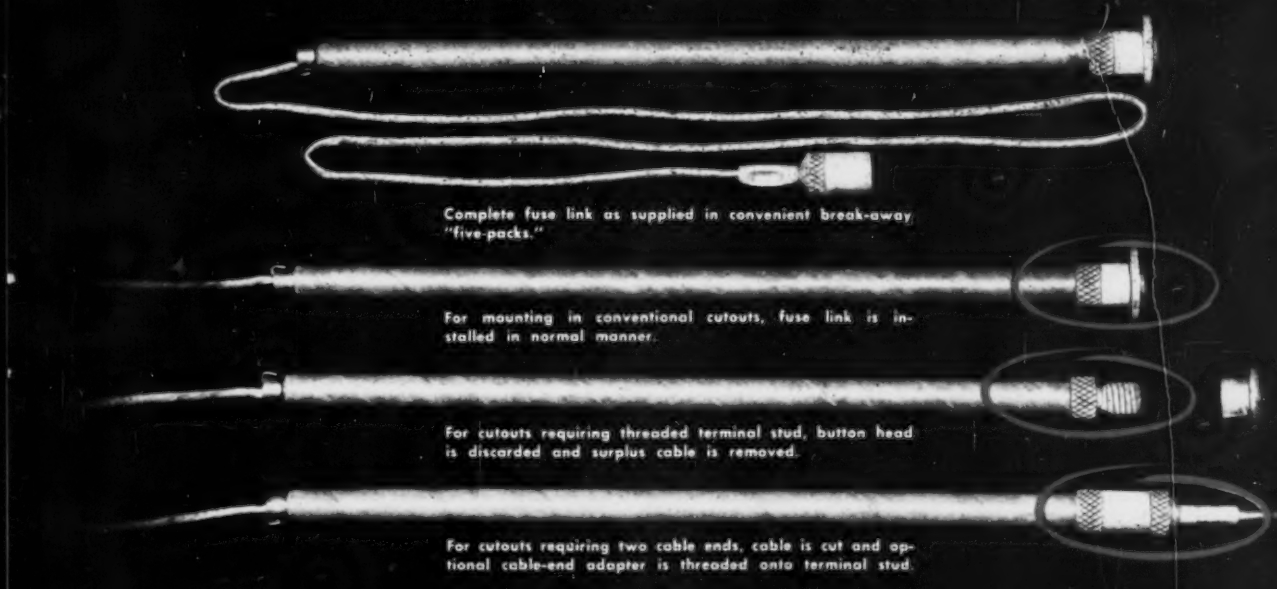

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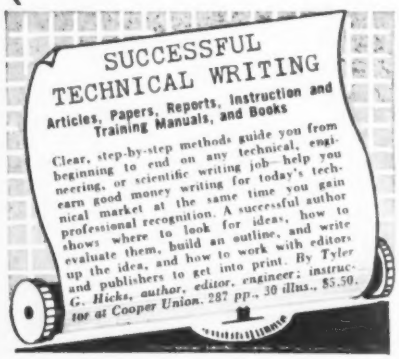
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Class in cable splicing conducted by Arizona Joint Industry Board and the utility

Teach Splicing

Another course in cable splicing and terminating of high-voltage cable in the 5,000- to 15,000-v category started the first Saturday in November through the auspices of the Electrical Joint Industry Board of Arizona in the Phoenix area. A similar course, pictured here, was completed earlier in the year.

The course was offered to journeyman electricians in order to train personnel for installation of high-voltage cables. Much of this work is being installed in the big construction program now under way in Arizona.

Supplies and materials in the course were furnished by Simplex Wire & Cable Co. Observers at the final session were David Walkington, Jerome Kelleher and Neal Tracy of the joint board. Dennis Don of Simplex conducted the classes.

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Meetings Calendar

JANUARY 1960

11-15—*Winter Market*, Western Merchandise Mart, San Francisco.

29—*Illuminating Engineering Society*, South Pacific Regional Activities Committee, Santa Barbara, Calif.

FEBRUARY

—*Intermountain Electrical Assn.*, annual conference.
13—*Snake River Valley Electrical Assn.*, annual conference.
—*San Diego Bureau of Home Appliances*, spring conference, House of Hospitality, Balboa Park, San Diego.
29-March 1—*Pacific Coast Electrical Assn.*, Business Development Section, Hotel Lafayette, Long Beach.

MARCH

23-25—*Electrical Maintenance Engineers Assn. of California*, Industry Lighting Conference and Show, Shrine Exposition Auditorium, Los Angeles.
28-29—*Pacific Coast Electrical Assn.*, Engineering and Operating Section conference, San Francisco area.

APRIL

11-12—*Pacific Coast Electrical Assn.*, Administrative Services, conference, Huntington-Sheraton Hotel, Pasadena.
—*International Association of Electrical Inspectors*, Utah chapter annual meeting.
—*IAEI*, Idaho Chapter annual meeting.

(Continued on p 135)

Meetings Calendar

(Continued

27-29—*Northwest Electric Light & Power Assn.*, Engineering and Operation Section, Personnel & Safety Section, Florence Hotel, Missoula, Mont.

27-30—*Western Air Conditioning, Heating, Ventilation & Refrigeration* Conference and Show, Shrine Exposition Auditorium, Los Angeles.

28-29—*Illuminating Engineering Society*, Intermountain Regional Conference, Hotel Westward Ho, Phoenix.

—*San Diego Bureau of Home Appliances*, annual Spring Fair, Balboa Park.

MAY

3-5—*Western Joint Computer Conference*, San Francisco.

4-5—*Illuminating Engineering Society*, South Pacific Regional Conference, Hotel Ambassador, Los Angeles.

9-10—*IES*, Pacific Northwest Regional Conference, Benjamin Franklin Hotel, Seattle.

—*National Electrical Contractors Assn.*, District 5, and IBEW, District 7, joint meeting, Westward Ho Hotel, Phoenix.

9-12—*NECA*, Tri-District (Districts 6, 8, 9) regional conference, Olympic Hotel, Seattle.

16-18—*Pacific Coast Electrical Assn.*, annual convention, Stardust Hotel, Las Vegas.

23-25—*Northwest Electric Light & Power Assn.*, Business Development Section, Chinook Hotel, Yakima.

JUNE

15-17—*Northwest Electric Light & Power Assn.*, Accounting & Business Practice Section, Hotel Benson, Portland.

15-17—*National Conference of Utility* Radio, Continental-Denver Motel, Denver.

SEPTEMBER

7-9—*Northwest Electric Light & Power Assn.*, 53rd annual meeting, Glacier Park Lodge, Mont.

12-14—*International Association of Electrical Inspectors*, Northwestern Section, Sheraton-Portland Hotel, Portland.

18-24—*IAEI*, Southwestern Section, Mapes Hotel, Reno.

NOVEMBER

17-22—*National Association of Electrical Distributors*, Western Region convention, Stardust Hotel, Las Vegas.

23-27—*National Electrical Contractors Assn.*, national convention and exposition, Las Vegas.

DECEMBER

12-15—*Atomic Industries Exhibition*, Masonic Auditorium, AIF—Fairmont Hotel, ANS—Mark Hopkins Hotel, San Francisco.

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International Business Machines 44, 45

Los Angeles DUnkirk 1-3696
San Francisco YUkon 2-0100
Denver AComa 2-9373
Seattle MUtual 2-4640
Portland CApitol 8-6623
Salt Lake ELgin 9-7721

Joslyn Mfg. and Supply Co. 115

Los Angeles LUdlow 7-4251
San Francisco UNderhill 1-7313
Seattle MAin 3-1957
Portland CApitol 3-5127
Phoenix ALpine 2-1245
Salt Lake City EM 3-2084

Kraloy Plastic Pipe Co. Inc. 113

Los Angeles: Angelus 1-4158
San Francisco: The Curry Co. YUkon 2-0788
Seattle: Fred Carlson Co. ATwater 4-4630
Denver: Kenneth B. Schomann Co. FRemont 7-3023
Albuquerque: Ralph B. Black ALpine 5-9625

Kuhlman Electric Co. 54

Maydwell & Hartzell, Inc., in following cities:
San Francisco ATwater 8-6900
Los Angeles MAdison 8-7245
Seattle MAin 4-2368
Portland CApitol 8-4173
Phoenix ALpine 2-5858
Spokane MAdison 4-3285
San Diego JU 2-6749
Denver: Sales Engineers AComa 2-4893
Salt Lake City: Sales Engineers HUnter 5-3547

WESTERN SALES OFFICES

December 1959

Lighting Dynamics 138

San Diego KImberly 5-4993
Los Angeles RAymond 3-9101
San Francisco JUniper 6-5266
Portland: Clyde Dodd CApitol 7-6557
Seattle: Don Gleason LAkeview 5-5151
Phoenix: Ray Wendling ALpine 2-2541

Line Material Industries 3, 24, 25

San Francisco PLaza 5-8600
Los Angeles RAymond 3-6251
Portland CApitol 2-1981
Seattle ATwater 3-6368
Spokane KEystone 5-2461
Salt Lake City ELgin 5-6257
Phoenix: J. E. Redmond Supply ALpine 4-8471
Boise Phone: 2-5706
Butte Phone: 8340
Denver FL 5-1689 and 1680
Sacramento, Calif. GI 2-6264

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Minnesota Mining & Mfg. Co. 57

San Francisco PLaza 6-0800
Los Angeles RAymond 3-6641
Seattle MUtual 2-5550

Moloney Electric Co. 109

Garland Affolter in following cities:
San Francisco EXbrook 7-1800
Los Angeles MAdison 4-1864
Portland CApitol 3-7349
Seattle MUtual 2-4950
Denver: Hamilton Associates CHerry 4-1505
Salt Lake: Riter Engineering EMpire 3-7933

Morrison-Pelsue 126

Denver RAce 2-2834
North Hollywood: A. F. Johnson STate 7-8544
Salt Lake City: W. H. Pingree Co. EMpire 3-6731
San Francisco: Brenton Equip. Co. EXbrook 2-8185
Los Angeles: Golsan Co. RIchmond 7-5486
Spokane: Tinling & Powell TEmple 8-8276

Pacific Gas and Electric Co. 53

San Francisco SUtter 1-4211

Paranite Wire & Cable Div., Essex Wire Corp. 30

Los Angeles RAymond 3-4794
South San Francisco PLaza 6-3030
Portland CApitol 3-6124
Seattle MAin 3-5641

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San Francisco: George E. Honn Co. SUtter 1-7352
Los Angeles: John G. Corrin MAdison 2-0830
Seattle: Fred W. Carlson ATwater 4-4630
Phoenix: Roy E. Coulson WIndsor 3-8935
Denver: Peterson Co. DExter 3-5434
Salt Lake City: Clarence W. Silver ELgin 5-5378
Portland: Fred W. Carlson & Associates CApitol 8-3798
Boise, Ida.: Clarence W. Silver Co. 2-6947

Albuquerque: Williamson Sales Co. ALpine 6-6617

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Los Angeles RAymond 3-1311 and PArkview 1-1191
Seattle MAin 3-6790
Denver CHerry 4-9291 and CHerry 4-9292

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Oakland OLympic 2-7237
Sacramento: Robert Crownin GIlbert 3-8543
Portland: Bardi Gen. Contractors PRospect 5-4354
Los Angeles: Construction Supply Co. LUdlow 3-4158
Los Angeles: Ball & Black ANgelus 9-7586
Santa Ana: Blystone Equip. Co. KImberly 2-3918

R T & E Corp. 2nd Cover

Portland MErcury 9-2161
Medford: H. L. Mooney SPring 2-9948
San Jose: N. R. Beebe ANdrews 4-5641
Pasadena: D. B. Cole SYlvan 0-5977
Salt Lake City: T. R. Van Wagoner Co. INgersol 6-2461
Bellevue, Wn.: K. H. DuBois SHerwood 6-4114
Butte: R. A. Manning Butte 2-9200

Ripley Co. 135

Portland: Wm. J. Cottrell CApitol 7-6191
Phoenix: W. H. Eddy ALpine 2-6322
Oakland: J. H. Ormond Co. TWinoaks 3-3235
Los Angeles: A. W. Nash Co. ANgelus 9-7304

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Seattle: Palmer Electric Co. MA 2-2170
Spokane: Wm. C. Knapp FAirfax 7-3621
Spokane: Inland Electric Co. FAirfax 7-1521
Tacoma: Bean Electric Co. MArket 7-3144
Los Angeles: O. B. Wilt Co. NOrmandy 1-4100
San Carlos, Calif.: O. B. Wilt Co. LYtel 1-2618
Graybar Electric Co. Inc., all principal cities

Royal Electric Corp. 56

Los Angeles: Eckert-Lloyd Co. Richmond 7-9655
San Francisco: Eckert-Lloyd Co. HEmlock 1-5792
Seattle: Northwestern Agencies MAin 3-8882
Portland: Northwestern Agencies CApitol 7-0434
Phoenix: Wm. Benedorf CRestwood 7-1662
Denver: Hyde Electronics Co. WEst 6-3456

Sangamo Electric Co. 125, 127, 129

San Francisco: L. A. Nott HEmlock 1-4738
Los Angeles: (Factory Sales) DUnkirk 7-2336
(Time Switches) ANgelus 8-6771
Seattle: T. R. Wood MAin 3-8204
Denver: Mt. States Machinery CHerry 4-7421
Phoenix: J. E. Redmond Co. ALpine 4-8471
Portland: R. L. Schoenberger CApitol 3-8742
Butte: R. E. McDonough Butte 2-5447
Tucson AXtel 8-4801
Albuquerque: Gorman Engineering CHapel 7-1596
El Paso: Gorman Engineering KEystone 2-3449

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Los Angeles MAdison 5-7341

Southern California Edison Co. 34

Los Angeles MAdison 4-7111

Southern States Equipment Corp. 19

Seattle: Jos. C. Platt MAin 3-6141
Salt Lake City: H. Lee Rawlings Co. ELgin 9-8811
Denver: R. T. Lewis Co. EAst 2-1082
Los Angeles: W. E. Kirk Co. MAdison 4-3651
Lake Grove, Ore.: C. F. Selby NEptune 6-1486
Oakland: John H. Ormond TWinoaks 3-3235

Standard Oil Co. of Calif. 28

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Los Angeles MAdison 4-2711
Portland CApitol 3-4161
Seattle MAin 3-6310
Salt Lake City DAvis 2-5831

Subox, Inc. 21

San Francisco: Wrathall & Krusi EXbrook 7-3593
Los Angeles: R. E. Cunningham & Son MAdison 8-1105
Portland: Wm. J. Cottrell & Assoc. CApitol 7-6191
Seattle: W. R. Hendry Co. MAine 3-3968
Denver: Ambler Co. TAbor 5-8885

Truck Equipment Co. 20

Los Angeles: Calavar Corp. RIchmond 8-6292
Oakland: Dailey Body Co. KEllog 4-1423
Portland: Schatky Equipment Corp. BEaverton 4-5344
Spokane: Leland Trailer & Equip. Co. KEystone 4-0591
Salt Lake City: W. H. Pingree Co. EMpire 3-6731

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Atherton, Calif.: W. G. Sawyer DAvenport 5-4931
Fullerton: Wm. K. Newell TRojan 1-1845
Phoenix: Ray E. Wendling ALpine 2-2541
Seattle: Donald S. Gleason LAkeview 5-5151
Portland: Clyde E. Dodd BUtler 5-3271

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El Segundo, Calif. ORegon 8-7671
Portland CApitol 7-3654
Salt Lake City EMpire 3-5013
Denver CHerry 4-7421
Seattle MAin 2-2342

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Los Angeles MAdison 6-3881
Denver KEystone 4-8121
Phoenix ALpine 8-8621
Salt Lake City ELgin 5-3413
Seattle MAin 2-0808
Portland CApitol 2-9151
Spokane FAirfax 8-3371

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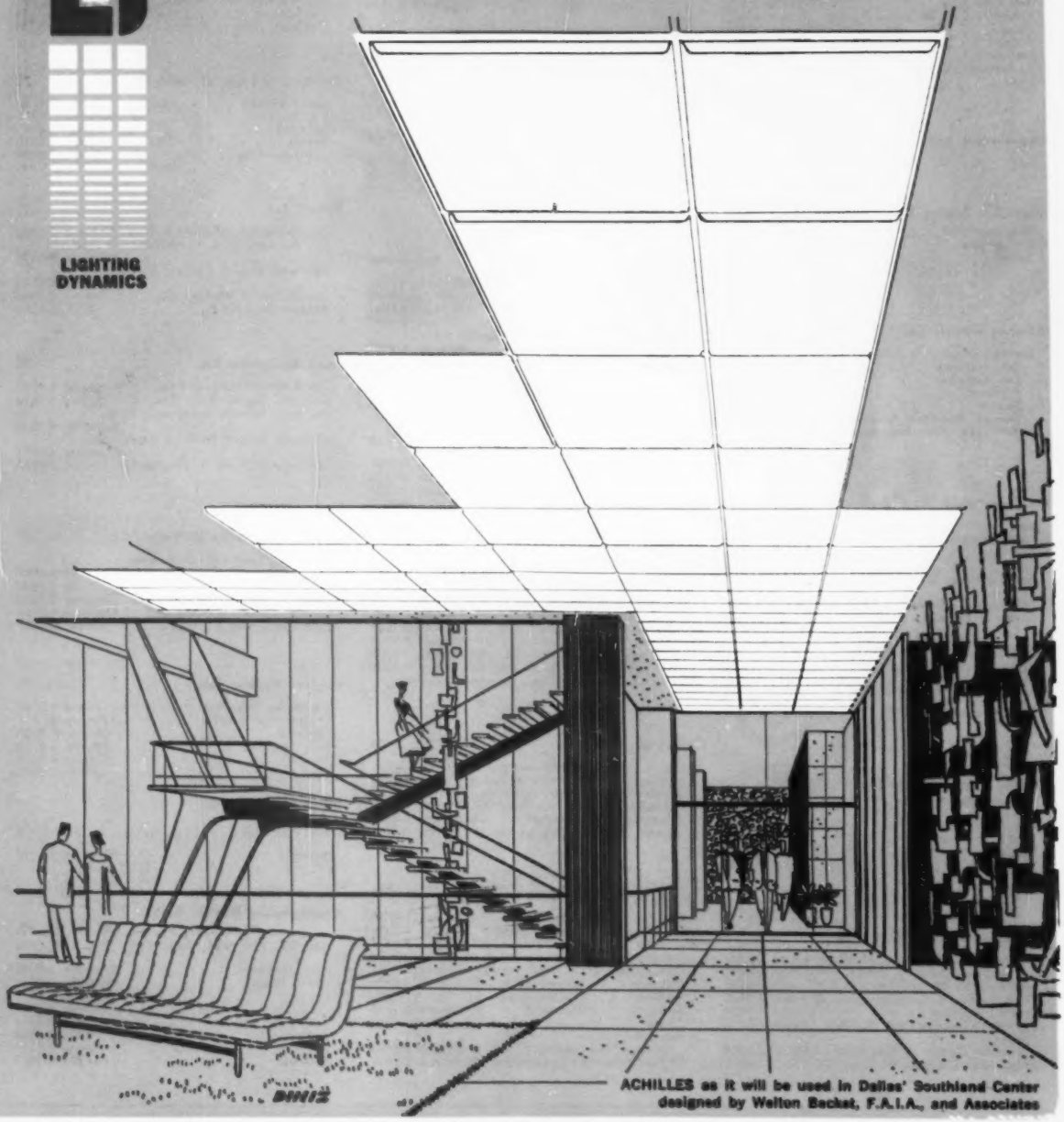
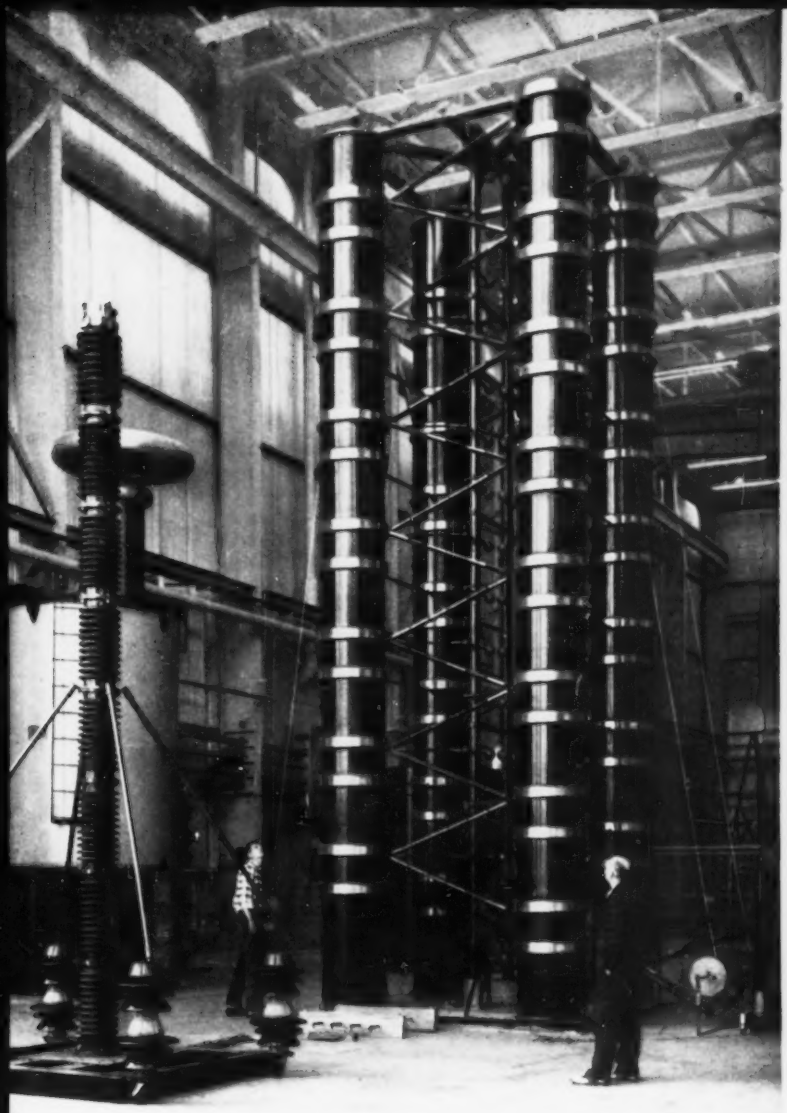
ACHILLES by Lighting Dynamics was specified for the lobby... and it's companion Apollo was used in the offices throughout the center. Achilles is a highly versatile fixture series ideal for this demountable acoustical ceiling—just as it is for countless other ceiling suspension systems. It's quickly installed with a drop-in installation and has easy maintenance with press-to-open catches and hook-on hinges. Durable, Bonderized and electro-static, high-reflectance finishes... FOR MORE COMPLETE INFORMATION, call your Lighting Dynamics representative, or write to Lighting Dynamics, 802 West Whittier Blvd., Whittier, California or Lighting Dynamics, 8700 Ambassador Row, Dallas, Texas.

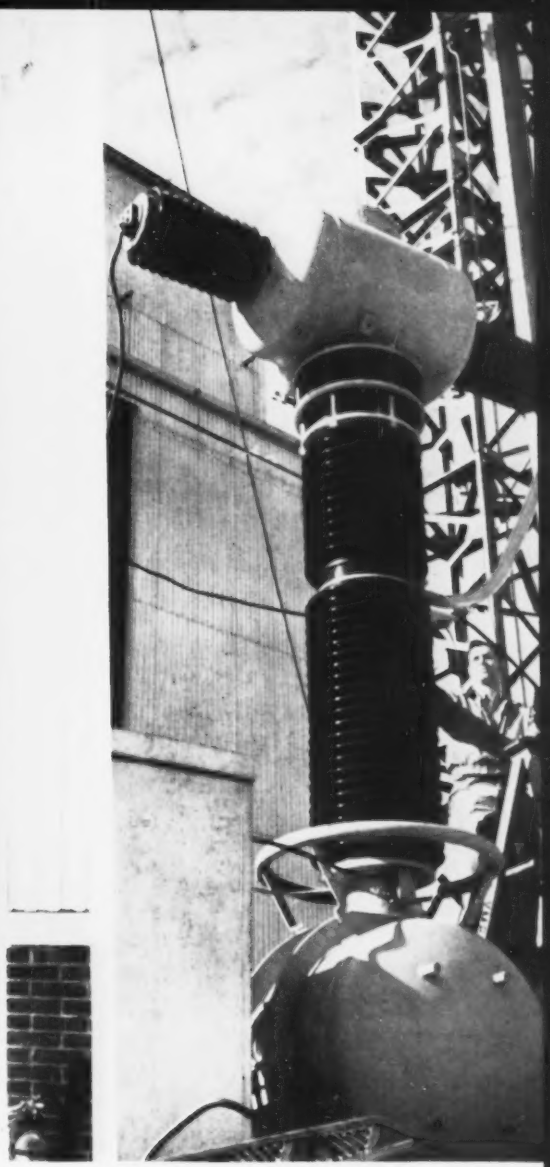
LIGHTING DYNAMICS



ACHILLES as it will be used in Dallas' Southland Center designed by Welton Becket, F.A.I.A., and Associates



THE THREE MILLION-VOLT IMPULSE GENERATOR is housed in a windowless, single-span, high-bay structure 63 feet wide, 187 feet long, and 65 feet high.



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